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Iowa Department of Agriculture and Land Stewardship

Iowa State University
Iowa Agriculture and Home Economics Experiment Station

Iowa State University
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In cooperation with Iowa Agriculture and Home Economics Experiment Station and Cooperative Extension Service, Iowa State University; and Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

# Soil Survey of Shelby County, Iowa

## Part I

# How To Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is divided into groups of soils called associations. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the soil associations on the color-coded map legend, and then refer to the section **General Soil Map Units** in Part I for a general description of the soils in your area.

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets** in Part III. Note the number of the map sheet, and turn to that sheet. Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. The **Contents** in Part I lists the map units and shows the page where each map unit is described.

The **Contents** in Part II shows which table has information on a specific land use or soil property for each detailed soil map unit. Also, see the **Contents** in Part I and Part II for other sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 2003. Soil names and descriptions were approved in 2004. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 2004. The most current official data are available through the NRCS Web Soil Survey (http://soils.usda.gov).

This survey was made cooperatively by the Natural Resources Conservation Service; the Iowa Agriculture and Home Economics Experiment Station and Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. The survey is part of the technical assistance furnished to the Shelby County Soil and Water Conservation District. Funds appropriated by Shelby County were used to defray part of the cost of the survey.



**Cover: A combination of terraces and contour farming in the Exira-Marshall-Judson association southeast of Prairie Rose State Park.**

*Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.*

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# Foreword

Soil surveys contain information that affects land use planning in survey areas. They include predictions of soil behavior for selected land uses. The surveys highlight soil limitations, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

Soil surveys are designed for many different users. Farmers, foresters, and agronomists can use the surveys to evaluate the potential of the soil and the management needed for maximum food and fiber production. Planners, community officials, engineers, developers, builders, and home buyers can use the surveys to plan land use, select sites for construction, and identify special practices needed to ensure proper performance. Conservationists, teachers, students, and specialists in recreation, wildlife management, waste disposal, and pollution control can use the surveys to help them understand, protect, and enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

These and many other soil properties that affect land use are described in this soil survey. Broad areas of soils are shown on the general soil map. The location of each soil is shown on the detailed soil maps. Each soil in the survey area is described, and information on specific uses is given. Help in using this publication and additional information are available at the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

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# Soil Survey of Shelby County, Iowa

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United States Department of Agriculture, Natural Resources Conservation Service, in cooperation with the Iowa Agriculture and Home Economics Experiment Station and Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

SHELBY COUNTY is in west-central Iowa (fig. 1). It is in the fourth tier of counties north of the Iowa-Missouri state line and is the second county east of the Missouri River. It has an area of about 378,300 acres, or about 590 square miles. Harlan, the county seat, is approximately 95 miles northwest of Des Moines, Iowa.

This survey updates the previous survey of Shelby County published in 1961 (Jury and others, 1961). It provides additional information and new maps, which show the soils in greater detail.

## How This Survey Was Made

This survey was made to provide updated information about the soils and miscellaneous areas in the survey area, which is in Major Land Resource Area (MLRA) 107B. Major land resource areas are geographically associated land resource units that share a common land use, elevation, topography, climate, water, soils, and vegetation (USDA, 2006). MLRA 107B is part of the Iowa and Missouri Deep Loess Hills.

The information in this survey includes a description of the soils and miscellaneous areas and their location and a discussion of their properties and the subsequent effects on suitability, limitations, and management for specified uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They dug many holes to study the soil profile, which is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

The soils and miscellaneous areas in the survey area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind or segment of the landscape. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landscape, soil

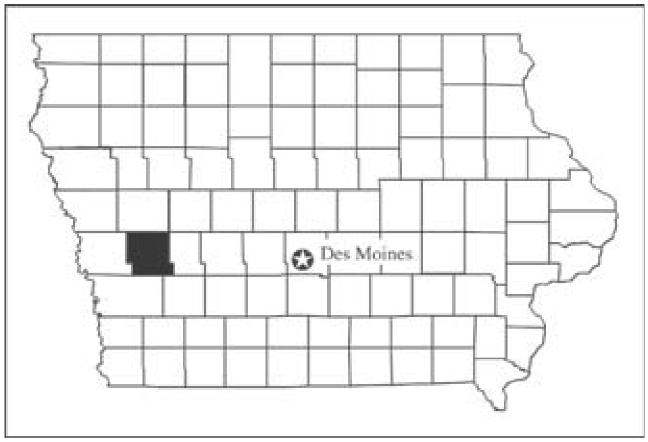


**Figure 1.—Location of Shelby County in Iowa.**

scientists develop a concept, or model, of how the soils were formed. Thus, during mapping, this model enables the soil scientists to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they observed. The maximum depth of observation was about 80 inches (6.7 feet). Soil scientists noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, soil reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Interpretations are modified as necessary to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over

long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a water table within certain depths in most years, but they cannot predict that the water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

The descriptions, names, and delineations of the soils in this survey area may not fully agree with those of the soils in adjacent survey areas. Differences are the result of an improved knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

## General Nature of the Survey Area

This section provides some general information about Shelby County. It describes history; industry, transportation facilities, and recreation; and climate.

### History

Before Iowa became a State in 1846, the area was primarily hunting and trapping ground for various Native American tribes, including the Pawnee, Omaha, and Otoe tribes from the west; the Sac, Fox, and Sioux tribes from the north; and the Iowa and Potawatomi tribes from the south.

Shelby County, originally a part of Keokuk County, was established in 1851, and the county government was organized in 1853 (Jury and others, 1961). The county was named in honor of General Isaac Shelby, an officer in the Revolutionary War and the first governor of Kentucky. The Mormons from Nauvoo, Illinois, were among the first settlers in Shelby County; they arrived in 1848. Many immigrants, including German, Danish, Norwegian, and Irish, established towns and communities throughout Shelby County.

In 1854, the population of Shelby County was 326. It was 17,932 in 1900 and 13,173 in 2000 (U.S. Department of Commerce, 2004). Shelby County has eleven incorporated towns and three unincorporated hamlets. Thirty-nine percent of the residents live in urban areas (areas having a population of at least 2,500), and the remaining 61 percent are in rural areas.

### Industry, Transportation Facilities, and Recreation

Agriculture is the primary industry and the dominant land use in Shelby County. Corn and soybeans have replaced prairie grasses and native timber. The county also has several hog operations. In 2002, cropland or pasture covered 347,500 acres, or 92 percent of the county (Iowa Agricultural Statistics Service, 2004). Currently, the average farm size is 404 acres. In 1970, the average farm size was 256 acres. Although the average farm size is increasing, the number of farms and of crop varieties is decreasing. About 82 percent of the land in the county is used for corn and soybeans. Oats, wheat, alfalfa hay, and other hay crops also are grown.

Farming practices have changed over the years. In 2000, Shelby County farmers harvested 123,320 acres of no-till corn and soybeans. Farm animals included more than 119,000 hogs and pigs, 40,000 head of cattle, and 2,100 sheep and lambs (Iowa Agricultural Statistics Service, 2004). Other industries include manufacturing applications, educational services, medical and mental health groups, and other service-oriented businesses. Mining and mineral resources are minimal.

Transportation facilities include highways, railroads, freight trucking companies, and one airport. Interstate 80 parallels Shelby County's southern boundary a couple of miles to the south. U.S. Highway 59 dissects the center of the county in a north-to-south direction. State Highway 44 crosses the center of the county from east to west. Freight is transported by truck or by railroad. Harlan Municipal Airport is located 4 miles south of Harlan.

Shelby County offers 1,770 acres of parks, including two native wildlife areas—the Derald Dinesen Prairie and Oak Ridge. There are numerous recreational areas and river access areas. The 422-acre Prairie Rose State Park includes 218 acres of lake.

## Climate

Table 1 gives data on temperature and precipitation for the survey area as recorded at Harlan, Iowa, in the period 1971 to 2000. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter, the average temperature is 23.4 degrees F and the average daily minimum temperature is 14.1 degrees. In summer, the average temperature is 72.6 degrees and the average daily maximum temperature is 83.4 degrees.

Growing degree days are shown in table 1. They are equivalent to “heat units.” During the month, growing degree days accumulate by the amount that the average temperature each day exceeds a base temperature (40 degrees F). The normal monthly accumulation is used to schedule single or successive plantings of a crop between the last freeze in spring and the first freeze in fall.

The total annual precipitation is about 33.4 inches. Of this total, 24.16 inches, or about 72 percent, usually falls in April through September. The growing season for most crops falls within this period.

The average seasonal snowfall is 32.1 inches. On the average, 54 days of the year have at least 1 inch of snow on the ground. The number of such days varies greatly from year to year.

Table 1.--Temperature and Precipitation

(Recorded in the period 1971-2000 at Harlan, Iowa)

| Month | Temperature | | | | | | Precipitation | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | 2 years in 10 will have-- | | | | 2 years in 10 will have-- | | | |
| | Average daily maximum | Average daily minimum | Average | Maximum temperature higher than-- | Minimum temperature lower than-- | Average number of growing degree days* | Average | Less than-- | More than-- | Average number of days with 0.10 inch or more | Average snowfall |
| | °F | °F | °F | °F | °F | Units | In | In | In | | In |
| January---- | 29.5 | 10.2 | 19.9 | 56 | -19 | 2 | 0.78 | 0.27 | 1.32 | 2 | 7.6 |
| February--- | 36.0 | 16.8 | 26.4 | 67 | -18 | 15 | .80 | .36 | 1.18 | 2 | 6.7 |
| March------ | 48.4 | 27.0 | 37.7 | 79 | -3 | 105 | 2.17 | .74 | 3.65 | 5 | 5.2 |
| April------ | 62.3 | 38.1 | 50.2 | 89 | 16 | 330 | 3.28 | 1.51 | 4.76 | 6 | 1.6 |
| May-------- | 73.0 | 49.8 | 61.4 | 91 | 31 | 664 | 4.18 | 2.34 | 5.86 | 8 | .0 |
| June------- | 82.4 | 59.6 | 71.0 | 97 | 43 | 930 | 4.35 | 2.28 | 6.40 | 6 | .0 |
| July------- | 85.2 | 64.0 | 74.6 | 98 | 48 | 1,072 | 4.10 | 1.89 | 6.30 | 5 | .0 |
| August----- | 82.7 | 61.9 | 72.3 | 96 | 46 | 1,002 | 3.79 | 1.77 | 5.59 | 5 | .0 |
| September-- | 75.7 | 52.7 | 64.2 | 94 | 31 | 725 | 4.46 | 1.59 | 6.97 | 5 | .0 |
| October---- | 63.4 | 40.6 | 52.0 | 86 | 18 | 386 | 2.68 | 1.02 | 4.41 | 4 | .9 |
| November--- | 46.0 | 27.3 | 36.7 | 71 | 2 | 79 | 1.79 | .69 | 2.90 | 3 | 3.1 |
| December--- | 32.7 | 15.3 | 24.0 | 59 | -15 | 6 | 1.01 | .44 | 1.53 | 2 | 7.0 |
| Yearly: | | | | | | | | | | | |
| Average--- | 59.8 | 38.6 | 49.2 | --- | --- | --- | --- | --- | --- | --- | --- |
| Extreme--- | 106 | -29 | --- | 100 | -22 | --- | --- | --- | --- | --- | --- |
| Total----- | --- | --- | --- | --- | --- | 5,316 | 33.39 | 27.24 | 39.42 | 53 | 32.1 |

* A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40 degrees F).

Table 2.--Freeze Dates in Spring and Fall

(Recorded in the period 1971-2000 at Harlan, Iowa)

| Probability | Temperature 24 °F or lower | 28 °F or lower | 32 °F or lower |
|---|---|---|---|
| Last freezing temperature in spring: | | | |
| 1 year in 10 later than-- | Apr. 18 | May 1 | May 18 |
| 2 years in 10 later than-- | Apr. 13 | Apr. 27 | May 12 |
| 5 years in 10 later than-- | Apr. 5 | Apr. 19 | Apr. 30 |
| First freezing temperature in fall: | | | |
| 1 year in 10 earlier than-- | Oct. 15 | Oct. 3 | Sept. 23 |
| 2 years in 10 earlier than-- | Oct. 19 | Oct. 7 | Sept. 27 |
| 5 years in 10 earlier than-- | Oct. 28 | Oct. 15 | Oct. 5 |

Table 3.--Growing Season

(Recorded in the period 1971-2000 at Harlan, Iowa)

| Probability | Daily minimum temperature during growing season: Higher than 24 °F | Higher than 28 °F | Higher than 32 °F |
|---|---|---|---|
| | Days | Days | Days |
| 9 years in 10 | 190 | 166 | 142 |
| 8 years in 10 | 196 | 172 | 149 |
| 5 years in 10 | 207 | 183 | 162 |
| 2 years in 10 | 219 | 194 | 174 |
| 1 year in 10 | 224 | 200 | 181 |

# General Soil Map Units

The general soil map in this publication shows broad areas that have a distinctive pattern of soils, relief, and drainage. These broad areas are called associations. Each association on the general soil map is a unique natural landscape. Typically, it consists of one or more major soils or miscellaneous areas and some minor soils or miscellaneous areas. It is named for the major soils or miscellaneous areas. The components of one association can occur in another but in a different pattern.

The general soil map can be used to compare the suitability of large areas for general land uses. Areas of suitable soils can be identified on the map. Likewise, areas where the soils are not suitable can be identified.

Because of its small scale, the map is not suitable for planning the management of a farm or field or for selecting a site for a road or building or other structure. The soils in any one association differ from place to place in slope, depth, drainage, and other characteristics that affect management.

## 1—Monona-Ida-Napier Association

*Extent of the association in the survey area:* 1 percent

### *Component Description*

**Monona**
*Extent:* 44 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Summits, shoulders, backslopes
*Geomorphic component:* Interfluves
*Slope range:* 5 to 9 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

**Ida**
*Extent:* 29 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes
*Geomorphic component:* Side slopes
*Slope range:* 14 to 20 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None

*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.6 inches
*Content of organic matter in the upper 10 inches:* 0.7 percent

**Napier**
*Extent:* 25 percent of the unit
*Geomorphic setting:* Hillslopes
*Geomorphic component:* Base slopes
*Slope range:* 2 to 5 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Local alluvium
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.1 inches
*Content of organic matter in the upper 10 inches:* 3.4 percent

### *Soils of Minor Extent*

**Burchard**
*Extent:* 1 percent of the unit

**Kennebec**
*Extent:* 1 percent of the unit

## 2—Monona-Judson-Ida Association

*Extent of the association in the survey area:* 35 percent

### *Component Description*

**Monona**
*Extent:* 55 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes, shoulders, summits
*Geomorphic component:* Interfluves
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

**Judson**
*Extent:* 17 percent of the unit
*Geomorphic setting:* Uplands
*Position on the landform:* Footslopes
*Geomorphic component:* Base slopes
*Slope range:* 2 to 5 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained

*Parent material:* Local alluvium
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.2 inches
*Content of organic matter in the upper 10 inches:* 4.4 percent

**Ida**
*Extent:* 15 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes
*Geomorphic component:* Side slopes
*Slope range:* 14 to 20 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.6 inches
*Content of organic matter in the upper 10 inches:* 0.7 percent

### *Soils of Minor Extent*

**Ackmore**
*Extent:* 6 percent of the unit

**Nodaway**
*Extent:* 5 percent of the unit

**Burchard**
*Extent:* 1 percent of the unit

**Zook**
*Extent:* 1 percent of the unit

## 3—Exira-Marshall-Judson Association

*Extent of the association in the survey area:* 48 percent

### *Component Description*

**Exira**
*Extent:* 32 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Shoulders, summits, backslopes
*Geomorphic component:* Interfluves
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 11.9 inches
*Content of organic matter in the upper 10 inches:* 1.7 percent

**Marshall**
*Extent:* 30 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes, shoulders, summits
*Geomorphic component:* Interfluves
*Slope range:* 5 to 9 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 11.6 inches
*Content of organic matter in the upper 10 inches:* 2.2 percent

**Judson**
*Extent:* 15 percent of the unit
*Geomorphic setting:* Uplands
*Position on the landform:* Footslopes
*Geomorphic component:* Base slopes
*Slope range:* 2 to 5 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Local alluvium
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.2 inches
*Content of organic matter in the upper 10 inches:* 4.4 percent

### *Soils of Minor Extent*

**Nodaway**
*Extent:* 12 percent of the unit

**Shelby**
*Extent:* 6 percent of the unit

**Ackmore**
*Extent:* 4 percent of the unit

**Adair**
*Extent:* 1 percent of the unit

## 4—Nodaway-Ackmore-Zook Association (fig. 2)

*Extent of the association in the survey area:* 8 percent

### *Component Description*

**Nodaway**
*Extent:* 42 percent of the unit
*Geomorphic setting:* Flood plains
*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)

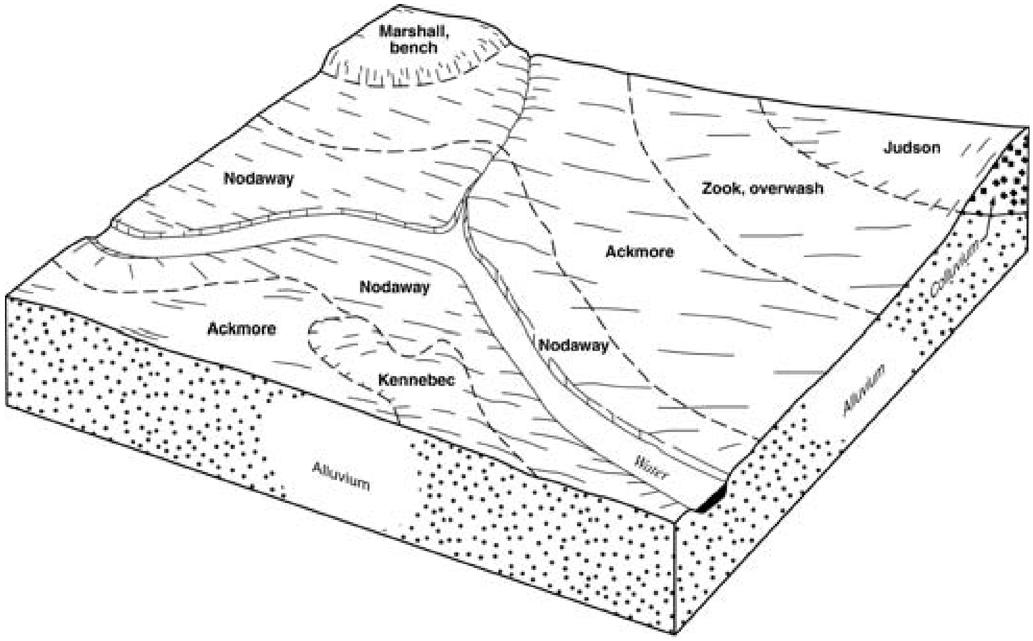


**Figure 2.—Typical pattern of soils and parent material in the Nodaway-Ackmore-Zook association.**

*Drainage class:* Moderately well drained
*Parent material:* Silty alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Occasional (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* 4.0 feet (April)
*Deepest depth to wet zone:* 6.5 feet (August, September, October)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.2 inches
*Content of organic matter in the upper 10 inches:* 2.2 percent

**Ackmore**
*Extent:* 32 percent of the unit
*Geomorphic setting:* Flood plains
*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Somewhat poorly drained
*Parent material:* Alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Occasional (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* 1.0 foot (April)
*Deepest depth to wet zone:* 4.0 feet (September)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.1 inches
*Content of organic matter in the upper 10 inches:* 2.6 percent

**Zook**
*Extent:* 25 percent of the unit
*Geomorphic setting:* Flood plains

*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Poorly drained
*Parent material:* Alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Occasional (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* At the surface (April)
*Deepest depth to wet zone:* 3.0 feet (September)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 7.2 inches
*Content of organic matter in the upper 10 inches:* 4.6 percent

### *Soils of Minor Extent*

**Marshall, bench**
*Extent:* 1 percent of the unit

## 5—Monona-Marshall-Judson Association

*Extent of the association in the survey area:* 8 percent

### *Component Description*

**Monona**
*Extent:* 44 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Shoulders, backslopes, summits
*Geomorphic component:* Interfluves
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

**Marshall**
*Extent:* 24 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Summits, shoulders
*Geomorphic component:* Interfluves
*Slope range:* 2 to 5 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.0 inches
*Content of organic matter in the upper 10 inches:* 3.2 percent

**Judson**
*Extent:* 17 percent of the unit
*Geomorphic setting:* Uplands
*Position on the landform:* Footslopes
*Geomorphic component:* Base slopes
*Slope range:* 2 to 5 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Local alluvium
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.2 inches
*Content of organic matter in the upper 10 inches:* 4.4 percent

### *Soils of Minor Extent*

**Ackmore**
*Extent:* 7 percent of the unit

**Ida**
*Extent:* 6 percent of the unit

**Nodaway**
*Extent:* 1 percent of the unit

**Zook**
*Extent:* 1 percent of the unit

# Detailed Soil Map Units

The map units delineated on the detailed soil maps in this survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. The contrasting components are mentioned in the map unit descriptions. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however, onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and lists some of the principal soil properties that should be considered in planning for specific uses.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown

on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Monona silty clay loam, 5 to 9 percent slopes, moderately eroded, is a phase of the Monona series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are called complexes. A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Judson-Ackmore-Colo, overwash, complex, 1 to 5 percent slopes, is an example (fig. 3).

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. The map unit Pits, sand and gravel, is an example.

The table “Acreage and Proportionate Extent of the Soils” in Part II lists the map units in this survey area. Other tables provided in Part II give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

## 1C3—Ida silt loam, 5 to 9 percent slopes, severely eroded

### *Component Description*

**Ida, severely eroded, and similar soils**
*Extent:* 70 to 90 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Summits, shoulders
*Slope range:* 5 to 9 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.6 inches
*Content of organic matter in the upper 10 inches:* 0.7 percent

### *Additional Components of Minor Extent*

**Monona, moderately eroded, and similar soils**
*Extent:* 10 percent of the unit

**Monona, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

## 1D3—Ida silt loam, 9 to 14 percent slopes, severely eroded

### *Component Description*

**Ida, severely eroded, and similar soils**
*Extent:* 70 to 90 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes, shoulders
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silt loam

**Figure 3.—A typical landscape in an area of Judson-Ackmore-Colo, overwash, complex, 1 to 5 percent slopes.**

*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.6 inches
*Content of organic matter in the upper 10 inches:* 0.7 percent

### *Additional Components of Minor Extent*

**Monona, moderately eroded, and similar soils**
*Extent:* 10 percent of the unit

**Monona, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

## 1E3—Ida silt loam, 14 to 20 percent slopes, severely eroded

### *Component Description*

**Ida, severely eroded, and similar soils**
*Extent:* 60 to 80 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes
*Slope range:* 14 to 20 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None

*Available water capacity to a depth of 60 inches:* 12.6 inches
*Content of organic matter in the upper 10 inches:* 0.7 percent

### *Additional Components of Minor Extent*

**Monona, moderately eroded, and similar soils**
*Extent:* 10 percent of the unit

**Monona, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

**Monona, slightly eroded, and similar soils**
*Extent:* 10 percent of the unit

## 1F3—Ida silt loam, 20 to 30 percent slopes, severely eroded

### *Component Description*

**Ida, severely eroded, and similar soils**
*Extent:* 50 to 90 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes
*Slope range:* 20 to 30 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.6 inches
*Content of organic matter in the upper 10 inches:* 0.7 percent

### *Additional Components of Minor Extent*

**Monona, moderately eroded, and similar soils**
*Extent:* 15 percent of the unit

**Burchard, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

**Monona, slightly eroded, and similar soils**
*Extent:* 5 percent of the unit

**Monona, severely eroded, and similar soils**
*Extent:* 5 percent of the unit

## 8B—Judson silty clay loam, 2 to 5 percent slopes

### *Component Description*

**Judson and similar soils**
*Extent:* 70 to 90 percent of the unit
*Geomorphic setting:* Alluvial fans; drainageways
*Position on the landform:* Footslopes
*Slope range:* 2 to 5 percent

*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Colluvium
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.2 inches
*Content of organic matter in the upper 10 inches:* 4.4 percent

### *Additional Components of Minor Extent*

**Ackmore and similar soils**
*Extent:* 10 percent of the unit

**Colo, overwash, frequently flooded, and similar soils**
*Extent:* 10 percent of the unit

## 8C—Judson silty clay loam, 5 to 9 percent slopes

### *Component Description*

**Judson and similar soils**
*Extent:* 90 to 100 percent of the unit
*Geomorphic setting:* Alluvial fans; drainageways
*Position on the landform:* Footslopes
*Slope range:* 5 to 9 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Colluvium
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.2 inches
*Content of organic matter in the upper 10 inches:* 4.4 percent

### *Additional Components of Minor Extent*

**Colo, overwash, frequently flooded, and similar soils**
*Extent:* 5 percent of the unit

## 9—Marshall silty clay loam, 0 to 2 percent slopes

### *Component Description*

**Marshall and similar soils**
*Extent:* 90 to 100 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Summits
*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None

*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.0 inches
*Content of organic matter in the upper 10 inches:* 3.2 percent

### *Additional Components of Minor Extent*

**Minden and similar soils**
*Extent:* 5 percent of the unit

## 9B—Marshall silty clay loam, 2 to 5 percent slopes

### *Component Description*

**Marshall and similar soils**
*Extent:* 100 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Summits
*Slope range:* 2 to 5 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.0 inches
*Content of organic matter in the upper 10 inches:* 3.2 percent

## 9C2—Marshall silty clay loam, 5 to 9 percent slopes, moderately eroded

### *Component Description*

**Marshall, moderately eroded, and similar soils**
*Extent:* 70 to 90 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Summits, shoulders
*Slope range:* 5 to 9 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 11.6 inches
*Content of organic matter in the upper 10 inches:* 2.2 percent

### *Additional Components of Minor Extent*

**Exira, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

**Marshall, slightly eroded, and similar soils**
*Extent:* 10 percent of the unit

## 9D2—Marshall silty clay loam, 9 to 14 percent slopes, moderately eroded

### *Component Description*

**Marshall, moderately eroded, and similar soils**
*Extent:* 60 to 80 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes, shoulders
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 11.6 inches
*Content of organic matter in the upper 10 inches:* 2.4 percent

### *Additional Components of Minor Extent*

**Exira, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Marshall, slightly eroded, and similar soils**
*Extent:* 10 percent of the unit

**Judson and similar soils**
*Extent:* 5 percent of the unit

## 10C2—Monona silt loam, 5 to 9 percent slopes, moderately eroded

### *Component Description*

**Monona, moderately eroded, and similar soils**
*Extent:* 65 to 85 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Summits, shoulders
*Slope range:* 5 to 9 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

### *Additional Components of Minor Extent*

**Monona, slightly eroded, and similar soils**
*Extent:* 20 percent of the unit

**Ida, severely eroded, and similar soils**
*Extent:* 5 percent of the unit

## 10D2—Monona silt loam, 9 to 14 percent slopes, moderately eroded

### *Component Description*

**Monona, moderately eroded, and similar soils**
*Extent:* 50 to 70 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes, shoulders
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 1.2 percent

### *Additional Components of Minor Extent*

**Ida, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Monona, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Monona, slightly eroded, and similar soils**
*Extent:* 5 percent of the unit

**Napier and similar soils**
*Extent:* 5 percent of the unit

## 10E2—Monona silt loam, 14 to 20 percent slopes, moderately eroded

### *Component Description*

**Monona, moderately eroded, and similar soils**
*Extent:* 30 to 50 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Shoulders, backslopes
*Slope range:* 14 to 20 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

### *Additional Components of Minor Extent*

**Monona, slightly eroded, and similar soils**
*Extent:* 30 percent of the unit

**Ida, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

**Monona, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

**Burchard, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

**Napier and similar soils**
*Extent:* 5 percent of the unit

## 10F2—Monona silt loam, 20 to 30 percent slopes, moderately eroded

### *Component Description*

**Monona, moderately eroded, and similar soils**
*Extent:* 35 to 55 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes
*Slope range:* 20 to 30 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

### *Additional Components of Minor Extent*

**Monona, slightly eroded, and similar soils**
*Extent:* 20 percent of the unit

**Ida, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Monona, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

**Burchard, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

**Napier and similar soils**
*Extent:* 5 percent of the unit

## 12B—Napier silt loam, 2 to 5 percent slopes

### *Component Description*

**Napier and similar soils**
*Extent:* 80 to 100 percent of the unit
*Geomorphic setting:* Drainageways; alluvial fans
*Position on the landform:* Footslopes
*Slope range:* 2 to 5 percent

*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Colluvium
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.1 inches
*Content of organic matter in the upper 10 inches:* 3.4 percent

### *Additional Components of Minor Extent*

**Danbury, rarely flooded, and similar soils**
*Extent:* 10 percent of the unit

## 12C—Napier silt loam, 5 to 9 percent slopes

### *Component Description*

**Napier and similar soils**
*Extent:* 90 to 100 percent of the unit
*Geomorphic setting:* Alluvial fans; drainageways
*Position on the landform:* Footslopes
*Slope range:* 5 to 9 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Colluvium
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.1 inches
*Content of organic matter in the upper 10 inches:* 3.4 percent

### *Additional Components of Minor Extent*

**Danbury, rarely flooded, and similar soils**
*Extent:* 5 percent of the unit

## 24E2—Shelby clay loam, 14 to 18 percent slopes, moderately eroded

### *Component Description*

**Shelby, moderately eroded, and similar soils**
*Extent:* 60 to 80 percent of the unit
*Geomorphic setting:* Hillslopes
*Position on the landform:* Backslopes
*Slope range:* 14 to 18 percent
*Texture of the surface layer:* Clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Glacial till
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 10.2 inches
*Content of organic matter in the upper 10 inches:* 2.2 percent

### *Additional Components of Minor Extent*

**Burchard, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Adair, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

**Exira, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

## 24F2—Shelby clay loam, 18 to 25 percent slopes, moderately eroded

### *Component Description*

**Shelby, moderately eroded, and similar soils**
*Extent:* 40 to 60 percent of the unit
*Geomorphic setting:* Hillslopes
*Position on the landform:* Backslopes
*Slope range:* 18 to 25 percent
*Texture of the surface layer:* Clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Glacial till
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 9.2 inches
*Content of organic matter in the upper 10 inches:* 1.8 percent

### *Additional Components of Minor Extent*

**Shelby, slightly eroded, and similar soils**
*Extent:* 40 percent of the unit

**Adair, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

**Burchard, severely eroded, and similar soils**
*Extent:* 5 percent of the unit

## 35D2—Liston-Burchard complex, 9 to 14 percent slopes, moderately eroded

### *Component Description*

**Liston, moderately eroded, and similar soils**
*Extent:* 45 to 65 percent of the unit
*Geomorphic setting:* Hillslopes
*Position on the landform:* Backslopes, shoulders
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Calcareous glacial till
*Flooding:* None

*Ponding:* None
*Available water capacity to a depth of 60 inches:* 9.9 inches
*Content of organic matter in the upper 10 inches:* 2.0 percent

**Burchard, moderately eroded, and similar soils**
*Extent:* 20 to 60 percent of the unit
*Geomorphic setting:* Hillslopes
*Position on the landform:* Backslopes
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Glacial till
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 9.2 inches
*Content of organic matter in the upper 10 inches:* 2.2 percent

### *Additional Components of Minor Extent*

**Adair, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

**Burchard, severely eroded, and similar soils**
*Extent:* 5 percent of the unit

## 54—Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded

### *Component Description*

**Zook, occasionally flooded, and similar soils**
*Extent:* 80 to 100 percent of the unit
*Geomorphic setting:* Flood plains
*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Poorly drained
*Parent material:* Alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Occasional (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* At the surface (April)
*Deepest depth to wet zone:* 3.0 feet (September)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 9.6 inches
*Content of organic matter in the upper 10 inches:* 5.1 percent

### *Additional Components of Minor Extent*

**Zook, overwash, occasionally flooded, and similar soils**
*Extent:* 10 percent of the unit

## 54+—Zook silt loam, 0 to 2 percent slopes, occasionally flooded, overwash

### *Component Description*

**Zook, overwash, occasionally flooded, and similar soils**
*Extent:* 75 to 95 percent of the unit
*Geomorphic setting:* Flood plains
*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Poorly drained
*Parent material:* Alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Occasional (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* At the surface (April)
*Deepest depth to wet zone:* 3.0 feet (September)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 7.2 inches
*Content of organic matter in the upper 10 inches:* 4.6 percent

### *Additional Components of Minor Extent*

**Zook, occasionally flooded, and similar soils**
*Extent:* 15 percent of the unit

## 59E2—Burchard clay loam, 14 to 18 percent slopes, moderately eroded

### *Component Description*

**Burchard, moderately eroded, and similar soils**
*Extent:* 65 to 85 percent of the unit
*Geomorphic setting:* Hillslopes
*Position on the landform:* Backslopes
*Slope range:* 14 to 18 percent
*Texture of the surface layer:* Clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Glacial till
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 9.2 inches
*Content of organic matter in the upper 10 inches:* 2.2 percent

### *Additional Components of Minor Extent*

**Liston and similar soils**
*Extent:* 15 percent of the unit

**Burchard, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

## 59F2—Burchard clay loam, 18 to 25 percent slopes, moderately eroded

### *Component Description*

**Burchard, moderately eroded, and similar soils**
*Extent:* 70 to 90 percent of the unit
*Geomorphic setting:* Hillslopes
*Position on the landform:* Backslopes
*Slope range:* 18 to 25 percent
*Texture of the surface layer:* Clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Glacial till
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 9.2 inches
*Content of organic matter in the upper 10 inches:* 2.2 percent

### *Additional Components of Minor Extent*

**Liston and similar soils**
*Extent:* 15 percent of the unit

**Burchard, severely eroded, and similar soils**
*Extent:* 5 percent of the unit

## 93D2—Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded

### *Component Description*

**Shelby, moderately eroded, and similar soils**
*Extent:* 55 to 75 percent of the unit
*Geomorphic setting:* Hillslopes
*Position on the landform:* Backslopes
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Glacial till
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 10.2 inches
*Content of organic matter in the upper 10 inches:* 2.2 percent

**Adair, moderately eroded, and similar soils**
*Extent:* 10 to 30 percent of the unit
*Geomorphic setting:* Hillslopes
*Position on the landform:* Backslopes
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)

*Drainage class:* Somewhat poorly drained
*Parent material:* Red paleosol weathered from glacial till
*Flooding:* None
*Shallowest depth to wet zone:* 1.0 foot (October)
*Deepest depth to wet zone:* More than 6.7 feet (January, February, July, August, September)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 9.2 inches
*Content of organic matter in the upper 10 inches:* 1.8 percent

### *Additional Components of Minor Extent*

**Exira, moderately eroded, and similar soils**
*Extent:* 10 percent of the unit

**Burchard, severely eroded, and similar soils**
*Extent:* 5 percent of the unit

## 99D2—Exira silty clay loam, 9 to 14 percent slopes, moderately eroded

### *Component Description*

**Exira, moderately eroded, and similar soils**
*Extent:* 40 to 60 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes, shoulders
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 11.9 inches
*Content of organic matter in the upper 10 inches:* 1.7 percent

### *Additional Components of Minor Extent*

**Exira, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Adair, moderately eroded, and similar soils**
*Extent:* 10 percent of the unit

**Marshall and similar soils**
*Extent:* 10 percent of the unit

**Shelby, moderately eroded, and similar soils**
*Extent:* 10 percent of the unit

**Judson and similar soils**
*Extent:* 5 percent of the unit

## 99E2—Exira silty clay loam, 14 to 18 percent slopes, moderately eroded

### *Component Description*

**Exira, moderately eroded, and similar soils**
*Extent:* 35 to 55 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes, shoulders
*Slope range:* 14 to 18 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 11.9 inches
*Content of organic matter in the upper 10 inches:* 1.7 percent

### *Additional Components of Minor Extent*

**Exira, severely eroded, and similar soils**
*Extent:* 30 percent of the unit

**Marshall and similar soils**
*Extent:* 10 percent of the unit

**Adair, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

**Judson and similar soils**
*Extent:* 5 percent of the unit

**Shelby, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

## 99F2—Exira silty clay loam, 18 to 25 percent slopes, moderately eroded

### *Component Description*

**Exira, moderately eroded, and similar soils**
*Extent:* 40 to 60 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes
*Slope range:* 18 to 25 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 11.9 inches
*Content of organic matter in the upper 10 inches:* 1.7 percent

### *Additional Components of Minor Extent*

**Exira, severely eroded, and similar soils**
*Extent:* 20 percent of the unit

**Marshall and similar soils**
*Extent:* 15 percent of the unit

**Shelby, moderately eroded, and similar soils**
*Extent:* 10 percent of the unit

**Judson and similar soils**
*Extent:* 5 percent of the unit

## 100B—Monona silty clay loam, 2 to 5 percent slopes

### *Component Description*

**Monona and similar soils**
*Extent:* 45 to 65 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Summits
*Slope range:* 2 to 5 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.9 inches
*Content of organic matter in the upper 10 inches:* 3.5 percent

### *Additional Components of Minor Extent*

**Monona, moderately eroded, and similar soils**
*Extent:* 45 percent of the unit

## 100C2—Monona silty clay loam, 5 to 9 percent slopes, moderately eroded

### *Component Description*

**Monona, moderately eroded, and similar soils**
*Extent:* 45 to 65 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Shoulders, summits
*Slope range:* 5 to 9 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

### *Additional Components of Minor Extent*

**Monona, slightly eroded, and similar soils**
*Extent:* 20 percent of the unit

**Monona, severely eroded, and similar soils**
*Extent:* 20 percent of the unit

**Ida, severely eroded, and similar soils**
*Extent:* 5 percent of the unit

## 100D2—Monona silty clay loam, 9 to 14 percent slopes, moderately eroded

### *Component Description*

**Monona, moderately eroded, and similar soils**
*Extent:* 35 to 55 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes, shoulders
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

### *Additional Components of Minor Extent*

**Monona, severely eroded, and similar soils**
*Extent:* 20 percent of the unit

**Ida, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Monona, slightly eroded, and similar soils**
*Extent:* 15 percent of the unit

**Judson and similar soils**
*Extent:* 5 percent of the unit

## 100D3—Monona silty clay loam, 9 to 14 percent slopes, severely eroded

### *Component Description*

**Monona, severely eroded, and similar soils**
*Extent:* 35 to 55 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Shoulders, backslopes
*Slope range:* 9 to 14 percent

*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.6 inches
*Content of organic matter in the upper 10 inches:* 0.8 percent

### *Additional Components of Minor Extent*

**Monona, moderately eroded, and similar soils**
*Extent:* 35 percent of the unit

**Ida, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Judson and similar soils**
*Extent:* 5 percent of the unit

## 100E2—Monona silty clay loam, 14 to 20 percent slopes, moderately eroded

### *Component Description*

**Monona, moderately eroded, and similar soils**
*Extent:* 35 to 55 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Shoulders, backslopes
*Slope range:* 14 to 20 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

### *Additional Components of Minor Extent*

**Monona, severely eroded, and similar soils**
*Extent:* 30 percent of the unit

**Ida, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Burchard, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

**Judson and similar soils**
*Extent:* 5 percent of the unit

## 100F2—Monona silty clay loam, 20 to 30 percent slopes, moderately eroded

### *Component Description*

**Monona, moderately eroded, and similar soils**
*Extent:* 45 to 65 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes
*Slope range:* 20 to 30 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

### *Additional Components of Minor Extent*

**Monona, severely eroded, and similar soils**
*Extent:* 25 percent of the unit

**Ida, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

**Burchard, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

**Judson and similar soils**
*Extent:* 5 percent of the unit

## 101F3—Monona-Ida complex, 20 to 30 percent slopes, severely eroded

### *Component Description*

**Monona, moderately eroded, and similar soils**
*Extent:* 30 to 50 percent of the unit
*Geomorphic setting:* Loess hills
*Position on the landform:* Backslopes
*Slope range:* 20 to 30 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

**Ida, severely eroded, and similar soils**
*Extent:* 30 percent of the unit
*Geomorphic setting:* Loess hills

*Position on the landform:* Backslopes
*Slope range:* 20 to 30 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.6 inches
*Content of organic matter in the upper 10 inches:* 0.7 percent

### *Additional Components of Minor Extent*

**Monona, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Monona, slightly eroded, and similar soils**
*Extent:* 10 percent of the unit

**Burchard, moderately eroded, and similar soils**
*Extent:* 5 percent of the unit

## 212—Kennebec silt loam, 0 to 2 percent slopes, occasionally flooded

### *Component Description*

**Kennebec, occasionally flooded, and similar soils**
*Extent:* 60 to 80 percent of the unit
*Geomorphic setting:* Flood plains
*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Moderately well drained
*Parent material:* Alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Occasional (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* 4.0 feet (April)
*Deepest depth to wet zone:* 6.5 feet (August, September, October)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.7 percent

### *Additional Components of Minor Extent*

**Nodaway, occasionally flooded, and similar soils**
*Extent:* 15 percent of the unit

**Colo, overwash, occasionally flooded, and similar soils**
*Extent:* 10 percent of the unit

**Zook, occasionally flooded, and similar soils**
*Extent:* 5 percent of the unit

## 220—Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded

### *Component Description*

**Nodaway, occasionally flooded, and similar soils**
*Extent:* 65 to 85 percent of the unit
*Geomorphic setting:* Flood plains
*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Moderately well drained
*Parent material:* Alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Occasional (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* 4.0 feet (April)
*Deepest depth to wet zone:* 6.5 feet (August, September, October)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.2 inches
*Content of organic matter in the upper 10 inches:* 2.2 percent

### *Additional Components of Minor Extent*

**Ackmore, occasionally flooded, and similar soils**
*Extent:* 20 percent of the unit

**Zook, occasionally flooded, and similar soils**
*Extent:* 5 percent of the unit

## 222D2—Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded

### *Component Description*

**Clarinda, moderately eroded, and similar soils**
*Extent:* 60 to 80 percent of the unit
*Geomorphic setting:* Hillslopes
*Position on the landform:* Shoulders, backslopes
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Poorly drained
*Parent material:* Gray paleosol weathered from glacial till
*Flooding:* None
*Shallowest depth to wet zone:* At the surface (March, April)
*Deepest depth to wet zone:* More than 6.7 feet (January, August, September)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 9.2 inches
*Content of organic matter in the upper 10 inches:* 1.9 percent

### *Additional Components of Minor Extent*

**Adair, moderately eroded, and similar soils**
*Extent:* 10 percent of the unit

**Exira, moderately eroded, and similar soils**
*Extent:* 10 percent of the unit

**Shelby, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

## 430—Ackmore silt loam, 0 to 2 percent slopes, occasionally flooded

### *Component Description*

**Ackmore, occasionally flooded, and similar soils**
*Extent:* 65 to 85 percent of the unit
*Geomorphic setting:* Flood plains
*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Somewhat poorly drained
*Parent material:* Alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Occasional (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* 1.0 foot (April)
*Deepest depth to wet zone:* 4.0 feet (September)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.1 inches
*Content of organic matter in the upper 10 inches:* 2.6 percent

### *Additional Components of Minor Extent*

**Nodaway, occasionally flooded, and similar soils**
*Extent:* 20 percent of the unit

**Zook, occasionally flooded, and similar soils**
*Extent:* 5 percent of the unit

## 431B—Judson-Ackmore-Colo, overwash, complex, 1 to 5 percent slopes

### *Component Description*

**Judson and similar soils**
*Extent:* 45 to 65 percent of the unit
*Geomorphic setting:* Alluvial fans; drainageways
*Position on the landform:* Footslopes
*Slope range:* 2 to 5 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Colluvium
*Flooding:* None
*Depth to wet zone:* More than 6.7 feet all year
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 13.2 inches
*Content of organic matter in the upper 10 inches:* 4.4 percent

**Ackmore, rarely flooded, and similar soils**
*Extent:* 15 to 35 percent of the unit
*Geomorphic setting:* Flood plains
*Slope range:* 1 to 3 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Somewhat poorly drained
*Parent material:* Alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Rare (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* 1.0 foot (April)
*Deepest depth to wet zone:* 4.0 feet (September)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.1 inches
*Content of organic matter in the upper 10 inches:* 2.6 percent

**Colo, overwash, frequently flooded, and similar soils**
*Extent:* 5 to 25 percent of the unit
*Geomorphic setting:* Flood plains
*Slope range:* 1 to 3 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Poorly drained
*Parent material:* Alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Frequent (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* At the surface (April)
*Deepest depth to wet zone:* 3.0 feet (September)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.0 inches
*Content of organic matter in the upper 10 inches:* 2.5 percent

### *Additional Components of Minor Extent*

**Nodaway, frequently flooded, and similar soils**
*Extent:* 5 percent of the unit

## 509—Marshall silty clay loam, bench, 0 to 2 percent slopes

### *Component Description*

**Marshall, bench, and similar soils**
*Extent:* 65 to 85 percent of the unit
*Geomorphic setting:* Stream terraces
*Position on the landform:* Summits
*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None

*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.0 inches
*Content of organic matter in the upper 10 inches:* 3.2 percent

### *Additional Components of Minor Extent*

**Judson and similar soils**
*Extent:* 15 percent of the unit

**Minden, bench, and similar soils**
*Extent:* 10 percent of the unit

## 509B—Marshall silty clay loam, bench, 2 to 5 percent slopes

### *Component Description*

**Marshall, bench, and similar soils**
*Extent:* 80 to 100 percent of the unit
*Geomorphic setting:* Stream terraces
*Position on the landform:* Summits
*Slope range:* 2 to 5 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.0 inches
*Content of organic matter in the upper 10 inches:* 3.2 percent

### *Additional Components of Minor Extent*

**Judson and similar soils**
*Extent:* 10 percent of the unit

## 509C—Marshall silty clay loam, bench, 5 to 9 percent slopes

### *Component Description*

**Marshall, bench, and similar soils**
*Extent:* 75 to 95 percent of the unit
*Geomorphic setting:* Stream terraces
*Position on the landform:* Summits
*Slope range:* 5 to 9 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.0 inches
*Content of organic matter in the upper 10 inches:* 3.2 percent

### *Additional Components of Minor Extent*

**Judson and similar soils**
*Extent:* 15 percent of the unit

## 509D2—Marshall silty clay loam, bench, 9 to 14 percent slopes, moderately eroded

### *Component Description*

**Marshall, bench, moderately eroded, and similar soils**
*Extent:* 55 to 75 percent of the unit
*Geomorphic setting:* Stream terraces
*Position on the landform:* Shoulders, backslopes
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 11.6 inches
*Content of organic matter in the upper 10 inches:* 2.2 percent

### *Additional Components of Minor Extent*

**Marshall, bench, slightly eroded, and similar soils**
*Extent:* 20 percent of the unit

**Judson and similar soils**
*Extent:* 15 percent of the unit

## 630—Danbury silt loam, 0 to 2 percent slopes, occasionally flooded

### *Component Description*

**Danbury, occasionally flooded, and similar soils**
*Extent:* 70 to 90 percent of the unit
*Geomorphic setting:* Flood plains
*Slope range:* 0 to 2 percent
*Texture of the surface layer:* Silt loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Moderately well drained
*Parent material:* Alluvium
*Months in which flooding does not occur:* January, December
*Highest frequency of flooding:* Occasional (February, March, April, May, June, July, August, September, October, November)
*Shallowest depth to wet zone:* 2.0 feet (April)
*Deepest depth to wet zone:* 5.0 feet (September)
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.3 inches
*Content of organic matter in the upper 10 inches:* 2.7 percent

### *Additional Components of Minor Extent*

**Kennebec, occasionally flooded, and similar soils**
*Extent:* 15 percent of the unit

**Colo, overwash, occasionally flooded, and similar soils**
*Extent:* 5 percent of the unit

## 700B—Monona silty clay loam, bench, 2 to 5 percent slopes

### *Component Description*

**Monona, bench, and similar soils**
*Extent:* 65 to 85 percent of the unit
*Geomorphic setting:* Stream terraces
*Position on the landform:* Summits
*Slope range:* 2 to 5 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.9 inches
*Content of organic matter in the upper 10 inches:* 3.5 percent

### *Additional Components of Minor Extent*

**Monona, bench, moderately eroded, and similar soils**
*Extent:* 25 percent of the unit

## 700C2—Monona silty clay loam, bench, 5 to 9 percent slopes, moderately eroded

### *Component Description*

**Monona, bench, moderately eroded, and similar soils**
*Extent:* 40 to 60 percent of the unit
*Geomorphic setting:* Stream terraces
*Position on the landform:* Shoulders, summits
*Slope range:* 5 to 9 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

### *Additional Components of Minor Extent*

**Monona, bench, slightly eroded, and similar soils**
*Extent:* 30 percent of the unit

**Monona, bench, severely eroded, and similar soils**
*Extent:* 15 percent of the unit

**Judson and similar soils**
*Extent:* 5 percent of the unit

## 700D2—Monona silty clay loam, bench, 9 to 14 percent slopes, moderately eroded

### *Component Description*

**Monona, bench, moderately eroded, and similar soils**
*Extent:* 50 to 70 percent of the unit
*Geomorphic setting:* Stream terraces
*Position on the landform:* Shoulders, backslopes
*Slope range:* 9 to 14 percent
*Texture of the surface layer:* Silty clay loam
*Depth to restrictive feature:* Very deep (more than 60 inches)
*Drainage class:* Well drained
*Parent material:* Loess
*Flooding:* None
*Ponding:* None
*Available water capacity to a depth of 60 inches:* 12.7 inches
*Content of organic matter in the upper 10 inches:* 2.1 percent

### *Additional Components of Minor Extent*

**Monona, bench, slightly eroded, and similar soils**
*Extent:* 25 percent of the unit

**Monona, bench, severely eroded, and similar soils**
*Extent:* 10 percent of the unit

**Judson and similar soils**
*Extent:* 5 percent of the unit

## 5010—Pits, sand and gravel

### *Component Description*

**Pits, sand and gravel**
*Definition:* This map unit consists of areas from which sand and gravel have been removed.
*Extent:* 100 percent of the unit
*Ponding:* None

## 5040—Udorthents, loamy

### *Component Description*

**Udorthents and similar soils**
*Extent:* 100 percent of the unit
*Texture of the surface layer:* Variable
*Parent material:* Loamy deposits
*Flooding:* None
*Ponding:* None

## 5080—Udorthents, sanitary landfill

***Component Description***

**Udorthents, sanitary landfill**
*Extent:* 100 percent of the unit
*Drainage class:* Moderately well drained

## AW—Animal waste lagoon

- This map unit consists of shallow ponds constructed to hold animal waste from farm feedlots.

## SL—Sewage lagoon

- This map unit consists of shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid waste.

## W—Water

- This map unit consists of natural bodies of water.

# Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (Soil Survey Staff, 1999 and 2003). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. The categories are defined in the following paragraphs.

ORDER. Twelve soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Mollisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Udoll (*Ud*, meaning humid, plus *oll*, from Mollisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; type of saturation; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Hapludolls (*Hapl*, meaning minimal horizonation, plus *udoll*, the suborder of the Mollisols that has a udic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic subgroup is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other taxonomic class. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Hapludolls.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineralogy class, cation-exchange activity class, soil temperature regime, soil depth, and reaction class. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, superactive, mesic Typic Hapludolls.

SERIES. The series consists of soils within a family that have horizons similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile.

The table “Classification of the Soils” in Part II of this publication indicates the order, suborder, great group, subgroup, and family of the soil series in the survey area.

## Soil Series and Their Morphology

In this section, each soil series recognized in the survey area is described. Characteristics of the soil and the material in which it formed are identified for each series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the “Soil Survey Manual” (Soil Survey Division Staff, 1993). Many of the technical terms used in the descriptions are defined in “Soil Taxonomy” (Soil Survey Staff, 1999) and in “Keys to Soil Taxonomy” (Soil Survey Staff, 2003). Unless otherwise indicated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

## *Ackmore Series*

### Typical Pedon

Ackmore silt loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; Shelby County, Iowa; 1,000 feet west and 210 feet north of the southeast corner of sec. 20, T. 79 N., R. 40 W.; USGS Portsmouth topographic quadrangle; lat. 41 degrees 37 minutes 54.7 seconds N. and long. 95 degrees 31 minutes 20 seconds W., NAD 83:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam; weak fine and medium subangular blocky structure; friable; many distinct black (10YR 2/1) organic stains on faces of peds; slightly acid; abrupt smooth boundary.

C1—7 to 17 inches; stratified very dark gray (10YR 3/1) and dark grayish brown (10YR 4/2) silt loam; massive with thin alluvial stratification; friable; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly acid; gradual smooth boundary.

C2—17 to 29 inches; stratified very dark grayish brown (10YR 3/2) and dark grayish brown (10YR 4/2) silt loam; massive with thin alluvial stratification; friable; common fine prominent strong brown (7.5YR 5/6) redoximorphic concentrations; slightly acid; clear smooth boundary.

Ab1—29 to 44 inches; black (10YR 2/1) silty clay loam; moderate fine and medium subangular blocky structure; friable; common fine faint very dark grayish brown (2.5Y 3/2) redoximorphic concentrations; neutral; clear smooth boundary.

Ab2—44 to 56 inches; black (10YR 2/1) silty clay loam; weak fine and medium subangular blocky structure; friable; few fine faint very dark grayish brown (2.5Y 3/2) redoximorphic concentrations; neutral; gradual smooth boundary.

Ab3—56 to 67 inches; very dark gray (10YR 3/1) silty clay loam; weak fine and medium subangular blocky structure; friable; common faint black (10YR 2/1) organic stains on faces of peds; common fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; neutral; gradual smooth boundary.

Ab4—67 to 76 inches; very dark gray (10YR 3/1) silty clay loam; weak medium subangular blocky structure; friable; common faint black (10YR 2/1) organic stains on faces of peds; common fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; neutral; gradual smooth boundary.

Bb—76 to 80 inches; very dark gray (10YR 3/1) silty clay loam; weak fine prismatic structure; friable; common faint black (10YR 2/1) organic stains on faces of peds; common fine prominent light olive brown (2.5Y 5/4) redoximorphic concentrations; neutral.

### Range in Characteristics

*Depth to buried soil:* 20 to 36 inches

*Ap or A horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam
Reaction—moderately acid to neutral

*C horizon:*
Hue—10YR
Value—2 to 5
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

*Ab horizon:*
Hue—10YR or N
Value—2 or 3
Chroma—0 or 1
Texture—silty clay loam or silt loam
Reaction—moderately acid to slightly alkaline

*Bb horizon:*
Hue—10YR
Value—3
Chroma—1
Texture—silty clay loam
Reaction—slightly acid to slightly alkaline

## *Adair Series*

### Typical Pedon

Adair clay loam, in an area of Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded, in a cultivated field in the uplands; Shelby County, Iowa; 2,100 feet east and 75 feet north of the southwest corner of sec. 15, T. 80 N., R. 37 W.; USGS Jacksonville topographic quadrangle; lat. 41 degrees 43 minutes 55.3 seconds N. and long. 95 degrees 08 minutes 38.9 seconds W., NAD 83:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) clay loam, brown (10YR 5/3) dry; weak fine granular structure; friable; many very fine roots; common very fine tubular pores; few fine prominent yellowish brown (10YR 5/6) iron masses; neutral; clear smooth boundary.

2Bt1—6 to 18 inches; strong brown (7.5YR 4/6) clay loam; weak fine subangular blocky structure; firm; few very fine roots; many very fine tubular pores; few prominent dark grayish brown (10YR 4/2) clay films on faces of peds; about 2 percent gravel; slightly acid; gradual smooth boundary.

2Bt2—18 to 33 inches; dark yellowish brown (10YR 4/6) and yellowish red (5YR 4/6) clay; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; very firm; few very fine roots; many very fine tubular pores; few prominent dark grayish brown (10YR 4/2) clay films on faces of peds; common fine prominent light brownish gray (2.5Y 6/2) redoximorphic depletions; about 2 percent gravel; moderately acid; gradual smooth boundary.

2Bt3—33 to 56 inches; dark yellowish brown (10YR 4/6) clay loam; weak fine and medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; many very fine tubular pores; few prominent dark grayish brown (10YR 4/2) clay films on faces of peds; few fine prominent black (10YR 2/1)

manganese masses; common fine and medium prominent light brownish gray (2.5Y 6/2) redoximorphic depletions; about 2 percent gravel; slightly acid; gradual smooth boundary.

2BC—56 to 69 inches; dark yellowish brown (10YR 4/6) clay loam; weak medium prismatic structure; friable; many very fine tubular pores; common fine prominent black (10YR 2/1) manganese masses; many medium prominent light brownish gray (2.5Y 6/2) redoximorphic depletions; about 2 percent gravel; slightly acid; gradual smooth boundary.

2C—69 to 80 inches; dark yellowish brown (10YR 4/6) clay loam; massive; friable; many very fine tubular pores; few fine prominent black (10YR 2/1) manganese masses; many medium and coarse prominent light brownish gray (2.5Y 6/2) redoximorphic depletions; about 2 percent gravel; slightly acid.

### Range in Characteristics

*Ap or A horizon:*
Hue—7.5YR or 10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam, clay loam, or silt loam
Reaction—moderately acid to neutral

*2Bt horizon:*
Hue—2.5YR to 10YR
Value—3 to 5
Chroma—3 to 6
Texture—clay or clay loam
Reaction—strongly acid to slightly acid

*2BC horizon:*
Hue—2.5YR to 10YR
Value—3 to 5
Chroma—3 to 6
Texture—clay loam
Reaction—moderately acid to slightly alkaline

*2C horizon:*
Hue—10YR
Value—4 or 5
Chroma—2 to 6
Texture—clay loam
Reaction—moderately acid to slightly alkaline

*Taxadjunct features:* The typical pedon for the Adair series in Shelby County is a taxadjunct because the surface layer is not thick enough to meet the requirements for a mollic epipedon. This soil is classified as an Oxyaquic Vertic Hapludalf.

## *Burchard Series*

### Typical Pedon

Burchard clay loam, in an area of Liston-Burchard complex, 9 to 14 percent slopes, moderately eroded, in an area of cropland in the uplands; Shelby County, Iowa; 925 feet west and 700 feet north of the southeast corner of sec. 35, T. 80 N., R. 40 W.; USGS Panama topographic quadrangle; lat. 41 degrees 41 minutes 25.6 seconds N. and long. 95 degrees 27 minutes 49.2 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) clay loam, brown (10YR 5/3) dry; weak fine subangular blocky structure parting to weak fine granular; friable; common fine and medium roots; few fine tubular pores; about 1 percent fine gravel; neutral; abrupt smooth boundary.

Bt—7 to 13 inches; brown (10YR 4/3) clay loam; weak fine subangular blocky structure; firm; few fine roots; common fine tubular pores; few distinct dark yellowish brown (10YR 4/6) clay films on faces of peds; about 1 percent fine gravel; neutral; abrupt wavy boundary.

Btk—13 to 32 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; firm; few very fine and fine roots; common fine tubular pores; common distinct dark yellowish brown (10YR 4/6) clay films on faces of peds; common fine prominent very pale brown (10YR 8/2) carbonate masses; few fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; about 2 percent fine gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk—32 to 52 inches; light olive brown (2.5Y 5/4) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common very fine tubular pores; common fine and medium prominent very pale brown (10YR 8/2) carbonate masses; few fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; few fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; about 3 percent fine gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

C—52 to 80 inches; light yellowish brown (2.5Y 6/3) clay loam; massive; firm; few very fine tubular pores; common medium prominent very pale brown (10YR 8/2) carbonate masses; few fine prominent yellowish brown (10YR 5/6) relict redoximorphic concentrations; few medium faint grayish brown (2.5Y 5/2) relict redoximorphic depletions; about 3 percent fine gravel; strongly effervescent; moderately alkaline.

## Range in Characteristics

*Depth to carbonates:* 12 to 30 inches

*Ap or A horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—clay loam
Reaction—moderately acid to neutral

*Bt horizon:*
Hue—10YR
Value—4 to 6
Chroma—2 to 6
Texture—clay loam
Reaction—slightly acid or neutral

*Btk horizon:*
Hue—10YR or 2.5Y
Value—4 to 6
Chroma—2 to 6
Texture—clay loam
Reaction—slightly alkaline or moderately alkaline

*Bk horizon:*
Hue—10YR or 2.5Y
Value—4 to 6

Chroma—2 to 6
Texture—clay loam
Reaction—slightly alkaline or moderately alkaline

*C horizon:*
Hue—10YR or 2.5Y
Value—6 or 7
Chroma—2 or 3
Texture—clay loam
Reaction—slightly alkaline or moderately alkaline

## *Clarinda Series*

### Typical Pedon

Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded, in a cultivated field in the uplands; Shelby County, Iowa; 500 feet west and 300 feet south of the northeast corner of sec. 21, T. 78 N., R. 38 W.; USGS Prairie Rose Lake topographic quadrangle; lat. 41 degrees 32 minutes 09.2 seconds N. and long. 95 degrees 12 minutes 08.8 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 5/3) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine roots; few fine tubular pores; slightly acid; abrupt smooth boundary.

2Btg1—7 to 15 inches; grayish brown (2.5Y 5/2) silty clay; weak fine subangular blocky structure; firm; few very fine roots; few very fine tubular pores; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; clear smooth boundary.

2Btg2—15 to 23 inches; grayish brown (2.5Y 5/2) silty clay; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; common very fine tubular pores; common distinct dark grayish brown (2.5Y 4/2) clay films on faces of peds; common medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly alkaline; gradual smooth boundary.

2Btg3—23 to 47 inches; gray (2.5Y 6/1) silty clay; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common very fine tubular pores; common distinct gray (2.5Y 5/1) clay films on faces of peds; common medium prominent yellowish brown (10YR 5/6) redoximorphic concentrations; slightly alkaline; gradual smooth boundary.

2Btg4—47 to 80 inches; gray (2.5Y 6/1) silty clay; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; common very fine tubular pores; common distinct gray (2.5Y 5/1) clay films on faces of peds; common medium prominent yellowish brown (10YR 5/6) and light olive brown (2.5Y 5/4) redoximorphic concentrations; neutral.

### Range in Characteristics

*Ap horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam
Reaction—neutral or slightly acid

*2Btg horizon:*
Hue—10YR to 5Y

Value—4 to 6
Chroma—1 or 2
Texture—silty clay or clay
Reaction—moderately alkaline to strongly acid

*Taxadjunct features:* The Clarinda soils in Shelby County are taxadjuncts because the surface layer is not thick enough to meet the requirements for a mollic epipedon. These soils are classified as fine, smectitic, mesic Vertic Epiaqualfs.

## *Colo Series*

### Typical Pedon

Colo silt loam, overwash, in an area of Judson-Ackmore-Colo, overwash, complex, 1 to 5 percent slopes, in a cultivated field; Shelby County, Iowa; 900 feet west and 70 feet south of the northeast corner of sec. 2, T. 79 N., R. 40 W.; USGS Panama topographic quadrangle, lat. 41 degrees 41 minutes 34 seconds N. and long. 95 degrees 27 minutes 47.3 seconds W., NAD 83:

Ap—0 to 7 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; weak fine granular structure; friable; common medium roots; few medium tubular pores; neutral; gradual smooth boundary.
A1—7 to 15 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common medium roots; common fine tubular pores; neutral; abrupt smooth boundary.
A2—15 to 40 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few fine roots; common fine tubular pores; neutral; gradual smooth boundary.
BA—40 to 50 inches; very dark gray (10YR 3/1) silty clay loam, gray (10YR 5/1) dry; weak fine prismatic structure parting to weak medium subangular blocky; friable; common fine tubular pores; common fine faint gray (2.5Y 4/1) redoximorphic depletions; neutral; gradual smooth boundary.
Bg—50 to 70 inches; dark gray (2.5Y 4/1) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; few fine tubular pores; common fine and medium faint dark grayish brown (2.5Y 4/2) redoximorphic depletions; common fine and medium prominent yellowish brown (10YR 5/4) redoximorphic concentrations; neutral; gradual smooth boundary.
BCg—70 to 80 inches; dark gray (2.5Y 4/1) silty clay loam; weak coarse prismatic structure; friable; few very fine tubular pores; common fine and medium faint dark grayish brown (2.5Y 4/2) redoximorphic depletions; neutral.

### Range in Characteristics

*Thickness of the mollic epipedon:* More than 36 inches
*Depth to carbonates:* More than 60 inches

*Ap or A horizon:*
Hue—10YR to 5Y or N
Value—2 or 3
Chroma—0 to 2
Texture—silty clay loam or silt loam
Reaction—moderately acid to neutral

*BA horizon:*
Hue—10YR to 2.5Y or N
Value—2 or 3
Chroma—0 to 2

Texture—silty clay loam
Reaction—moderately acid to neutral

*Bg horizon:*
Hue—10YR or 2.5Y
Value—2 to 4
Chroma—1
Texture—silty clay loam
Reaction—moderately acid to neutral

*BCg horizon:*
Hue—10YR to 5Y
Value—3 to 6
Chroma—1 or 2
Texture—silty clay loam
Reaction—moderately acid to neutral

## *Danbury Series*

### Typical Pedon

Danbury silt loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; Woodbury County, Iowa; 1,700 feet north and 500 feet west of the southeast corner of sec. 23, T. 88 N., R. 42 W.; USGS Cushing topographic quadrangle; lat. 42 degrees 25 minutes 34.1 seconds N. and long. 95 degrees 41 minutes 27.2 seconds W., NAD 83:

Ap—0 to 7 inches; about 95 percent very dark grayish brown (10YR 3/2) and 5 percent dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; weak fine subangular blocky structure; friable; common fine roots; many very fine pores; moderately acid; abrupt smooth boundary.

C1—7 to 15 inches; about 90 percent very dark grayish brown (10YR 3/2) and 10 percent dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; massive with weak thin alluvial stratification; friable; few very fine roots; many very fine pores; neutral; clear smooth boundary.

C2—15 to 25 inches; about 95 percent very dark grayish brown (10YR 3/2) and 5 percent dark brown (10YR 3/3) silt loam, brown (10YR 5/3) dry; massive with weak thin alluvial stratification; friable; few very fine roots; many very fine and fine tubular pores; neutral; clear smooth boundary.

C3—25 to 32 inches; about 95 percent very dark grayish brown (10YR 3/2) and 5 percent dark grayish brown (10YR 4/2) silt loam, brown (10YR 5/3) dry; massive with weak thin alluvial stratification; friable; few very fine roots; many very fine and fine tubular pores; common fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; neutral; abrupt wavy boundary.

2Ab1—32 to 43 inches; black (10YR 2/1) silty clay loam; weak very fine subangular blocky structure; friable; many very fine and fine tubular pores; common fine prominent strong brown (7.5YR 4/6) redoximorphic concentrations; neutral; gradual smooth boundary.

2Ab2—43 to 53 inches; black (10YR 2/1) silty clay loam; weak very fine and fine subangular blocky structure; friable; many very fine and fine tubular pores; common fine distinct brown (10YR 4/3) redoximorphic concentrations; neutral; gradual smooth boundary.

2Ab3—53 to 64 inches; black (10YR 2/1) silty clay loam; weak fine subangular blocky structure; friable; many very fine and fine tubular pores; common fine distinct brown (10YR 4/3) redoximorphic concentrations; neutral; clear smooth boundary.

2Bwb1—64 to 71 inches; very dark gray (10YR 3/1) silty clay loam; weak very fine prismatic structure parting to weak fine subangular blocky; friable; many very fine and fine tubular pores; common fine distinct brown (10YR 4/3) redoximorphic concentrations; neutral; clear smooth boundary.

2Bwb2—71 to 80 inches; very dark gray (10YR 3/1) silty clay loam; moderate very fine prismatic structure parting to weak fine subangular blocky; friable; many very fine and fine tubular pores; common fine distinct brown (10YR 4/3) redoximorphic concentrations; neutral.

### Range in Characteristics

*Ap or A horizon:*
Hue—10YR
Value—2 or 3
Chroma—2 or 3
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

*C horizon:*
Hue—10YR
Value—3 to 5
Chroma—2 to 4
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

*2Ab horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—slightly acid or neutral

*2Bwb horizon:*
Hue—10YR or 2.5Y
Value—3 or 4
Chroma—1 to 3
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

## *Exira Series*

### Typical Pedon

Exira silty clay loam, 14 to 18 percent slopes, moderately eroded, in a cultivated field; Shelby County, Iowa; about 2,600 feet east and 300 feet north of the southwest corner of sec. 29, T. 81 N., R. 37 W.; USGS Irwin topographic quadrangle; lat. 41 degrees 47 minutes 33.9 seconds N. and long. 95 degrees 10 minutes 49 seconds W., NAD 83:

Ap—0 to 6 inches; very dark grayish brown (10YR 3/2) silty clay loam, brown (10YR 5/3) dry; weak fine granular structure; friable; common fine roots; common fine tubular pores; moderately acid; abrupt smooth boundary.

Bw1—6 to 15 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; common very fine roots; common very fine tubular pores; common distinct very dark grayish brown (10YR 3/2) organic stains on faces of peds; common fine prominent strong brown (7.5YR 5/8) relict redoximorphic concentrations; common fine faint light brownish gray (10YR 5/2) relict redoximorphic depletions; slightly acid; gradual smooth boundary.

Bw2—15 to 28 inches; light olive brown (10YR 5/3) silty clay loam; weak fine prismatic structure parting to moderate fine subangular blocky; friable; common very fine roots; common very fine tubular pores; common distinct very dark grayish brown (10YR 3/2) organic stains on faces of peds; common fine prominent yellowish brown (10YR 5/6) relict redoximorphic concentrations; common fine faint light brownish gray (10YR 6/2) relict redoximorphic depletions; slightly acid; gradual smooth boundary.

BC—28 to 40 inches; light olive brown (2.5Y 5/3) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; common very fine tubular pores; common fine prominent yellowish brown (10YR 5/6) relict redoximorphic concentrations; common fine faint light brownish gray (10YR 6/2) relict redoximorphic depletions; neutral; gradual smooth boundary.

C1—40 to 60 inches; light olive brown (2.5Y 5/3) silt loam; massive; friable; common very fine tubular pores; many medium prominent yellowish brown (10YR 5/6) relict redoximorphic concentrations; many medium faint light brownish gray (10YR 6/2) relict redoximorphic depletions; neutral; gradual smooth boundary.

C2—60 to 80 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; common very fine tubular pores; many medium faint light brownish gray (10YR 6/2) relict redoximorphic depletions; many medium prominent strong brown (7.5YR 5/6) and common medium prominent yellowish red (5YR 5/6) relict redoximorphic concentrations; neutral.

## Range in Characteristics

*Ap or A horizon:*
Hue—10YR
Value—2 or 3
Chroma—2
Texture—silty clay loam
Reaction—moderately acid to neutral

*Bw horizon:*
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3
Texture—silty clay loam or silt loam
Reaction—moderately acid or slightly acid

*BC horizon:*
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—silty clay loam or silt loam
Reaction—moderately acid to neutral

*C horizon:*
Hue—10YR or 2.5Y
Value—5 or 6
Chroma—2 to 4
Texture—silt loam
Reaction—slightly acid or neutral

*Taxadjunct features:* The Exira soils in Shelby County are taxadjuncts because the surface layer is not thick enough to meet the requirements for a mollic epipedon. These soils are classified as fine-silty, mixed, superactive, mesic Dystric Eutrudepts.

## Ida Series

### Typical Pedon

Ida silt loam, 9 to 14 percent slopes, severely eroded, in a cultivated field in the uplands; Shelby County, Iowa; 1,200 feet south and 100 feet west of the northeast corner of sec. 34, T. 80 N., R. 40 W.; USGS Panama topographical quadrangle; lat. 41 degrees 42 minutes 02.1 seconds N. and long. 95 degrees 28 minutes 49.9 seconds W., NAD 83:

Ap—0 to 3 inches; brown (10YR 4/3) silt loam; weak fine subangular blocky structure parting to weak fine granular; friable; few very fine and fine roots; few fine tubular pores; common faint dark brown (10YR 3/3) organic coatings on faces of peds; slightly effervescent; slightly alkaline; clear smooth boundary.

C1—3 to 14 inches; brown (10YR 5/3) silt loam; massive; friable; common fine tubular pores; slightly effervescent; slightly alkaline; gradual smooth boundary.

C2—14 to 28 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; common fine tubular pores; strongly effervescent; slightly alkaline; gradual smooth boundary.

C3—28 to 69 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; common fine tubular pores; few fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; few fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; strongly effervescent; slightly alkaline; gradual smooth boundary.

C4—69 to 80 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; common fine tubular pores; few fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; few fine faint brown (7.5YR 4/4) relict redoximorphic concentrations; slightly effervescent; slightly alkaline.

### Range in Characteristics

*Depth to carbonates:* 0 to 10 inches

*Ap horizon:*
Hue—10YR
Value—3 to 5
Chroma—2 or 3
Texture—silt loam
Reaction—neutral to moderately alkaline
Note—the redoximorphic features are considered relict

*C horizon:*
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—3 to 6
Texture—silt loam
Reaction—slightly alkaline or moderately alkaline
Note—the redoximorphic features are considered relict

## Judson Series

### Typical Pedon

Judson silty clay loam, 2 to 5 percent slopes, in a cultivated field in a drainageway in the uplands; Shelby County, Iowa; 900 feet west and 200 feet south of the northeast corner of sec. 11, T. 81 N., R. 37 W.; USGS Manning SE topographic quadrangle; lat.

41 degrees 50 minutes 55.3 seconds N. and long. 95 degrees 07 minutes 08.8 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common fine roots; many fine tubular pores; slightly acid; abrupt smooth boundary.

A1—7 to 15 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak fine granular; friable; few very fine and fine roots; many very fine tubular pores; very many distinct very dark brown (10YR 2/2) organic stains on faces of peds; slightly acid; gradual smooth boundary.

A2—15 to 24 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few very fine roots; many very fine tubular pores; few distinct very dark brown (10YR 2/2) organic stains on faces of peds; slightly acid; gradual smooth boundary.

A3—24 to 32 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; few very fine roots; many very fine tubular pores; slightly acid; gradual smooth boundary.

AB—32 to 42 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine prismatic structure parting to weak fine subangular blocky; friable; few very fine roots; many very fine tubular pores; slightly acid; clear smooth boundary.

Bw1—42 to 52 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; many very fine tubular pores; common distinct dark brown (10YR 3/3) organic stains on faces of peds; slightly acid; gradual smooth boundary.

Bw2—52 to 61 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium prismatic structure parting to weak fine subangular blocky; friable; many very fine tubular pores; common fine faint yellowish brown (10YR 5/4) redoximorphic concentrations; slightly acid; clear smooth boundary.

Bw3—61 to 70 inches; yellowish brown (10YR 5/4) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; many very fine tubular pores; common fine faint brown (7.5YR 4/4) redoximorphic concentrations; common fine distinct grayish brown (10YR 5/2) redoximorphic depletions; slightly acid; gradual smooth boundary.

BC—70 to 80 inches; yellowish brown (10YR 5/4) silty clay loam; weak medium prismatic structure; friable; common very fine tubular pores; common fine distinct brown (7.5YR 5/2) and grayish brown (2.5Y 5/2) redoximorphic depletions; slightly acid.

## Range in Characteristics

*Depth to carbonates:* More than 60 inches
*Thickness of the mollic epipedon:* 32 to 52 inches

*Ap or A horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam
Reaction—moderately acid to neutral

*AB horizon:*
Hue—10YR
Value—2 or 3
Chroma—2

Texture—silty clay loam
Reaction—moderately acid to neutral

*Bw horizon:*
Hue—10YR
Value—3 to 5
Chroma—3 to 5
Texture—silty clay loam
Reaction—moderately acid to neutral

*BC horizon:*
Hue—10YR
Value—3 to 5
Chroma—3 or 4
Texture—silty clay loam or silt loam
Reaction—slightly acid to slightly alkaline

*C horizon (if it occurs):*
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silty clay loam or silt loam
Reaction—slightly acid to slightly alkaline

## *Kennebec Series*

### Typical Pedon

Kennebec silt loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; Shelby County, Iowa; 200 feet west and 1,600 feet south of the northeast corner of sec. 13, T. 80 N., R. 37 W; USGS Kimballton topographic quadrangle; lat. 41 degrees 44 minutes 29.8 seconds N. and long. 95 degrees 05 minutes 38.4 seconds W., NAD 83:

Ap—0 to 9 inches; very dark grayish brown (10YR 3/2) silt loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine roots; common fine tubular pores; neutral; abrupt smooth boundary.

A1—9 to 22 inches; black (10YR 2/1) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine roots; many fine tubular pores; neutral; gradual smooth boundary.

A2—22 to 32 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak very fine subangular blocky structure; friable; common very fine roots; many fine tubular pores; very many distinct black (10YR 2/1) organic stains on faces of peds; neutral; gradual smooth boundary.

A3—32 to 42 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak very fine prismatic structure parting to weak very fine subangular blocky; friable; common fine roots; many fine tubular pores; very many distinct black (10YR 2/1) organic stains on faces of peds; neutral; gradual smooth boundary.

A4—42 to 50 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine prismatic structure parting to weak fine subangular blocky; friable; common very fine roots; many fine tubular pores; many distinct black (10YR 2/1) organic stains on faces of peds; common fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; neutral; clear smooth boundary.

Bw1—50 to 64 inches; very dark grayish brown (10YR 3/2) silty clay loam; moderate medium prismatic structure parting to weak fine and medium subangular blocky;

friable; common fine roots; many fine tubular pores; many distinct very dark gray (10YR 3/1) organic stains on faces of peds; common fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; neutral; gradual smooth boundary.

Bw2—64 to 73 inches; very dark grayish brown (10YR 3/2) silty clay loam; moderate medium prismatic structure parting to weak medium subangular blocky; friable; many fine tubular pores; many distinct very dark gray (10YR 3/1) organic stains on faces of peds; few fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; neutral; clear smooth boundary.

C—73 to 80 inches; very dark grayish brown (2.5Y 3/2) silty clay loam; massive; friable; many fine tubular pores; many fine distinct yellowish brown (10YR 5/4) redoximorphic concentrations; neutral.

### Range in Characteristics

*Thickness of the mollic epipedon:* More than 40 inches
*Depth to carbonates:* More than 80 inches

*Ap or A horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

*Bw horizon:*
Hue—10YR
Value—2 to 4
Chroma—2 or 3
Texture—silty clay loam or silt loam
Reaction—slightly acid or neutral

*C horizon:*
Hue—10YR or 2.5Y
Value—2 to 4
Chroma—1 or 2
Texture—silty clay loam or silt loam
Reaction—slightly acid or neutral

## *Liston Series*

### Typical Pedon

Liston clay loam, in an area of Liston-Burchard complex, 9 to 14 percent slopes, moderately eroded, in a wooded pasture in the uplands; Shelby County, Iowa; 950 feet west and 1,450 feet south of the northeast corner of sec. 35, T. 78 N., R. 39 W.; USGS Corley topographic quadrangle; lat. 41 degrees 31 minutes 00.1 second N. and long. 95 degrees 17 minutes 35.3 seconds W., NAD 83:

A—0 to 7 inches; very dark grayish brown (10YR 3/2) clay loam, grayish brown (10YR 5/2) dry; weak fine granular structure; friable; common fine roots; common fine tubular pores; about 2 percent fine gravel; neutral; abrupt smooth boundary.

Bw—7 to 16 inches; brown (10YR 4/3) clay loam; moderate fine subangular blocky structure; firm; common fine roots; common fine tubular pores; common distinct very dark grayish brown (10YR 3/2) organic stains on faces of peds; common fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; common fine faint dark grayish brown (10YR 4/2) relict redoximorphic depletions; about 1

percent fine gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bk1—16 to 23 inches; dark yellowish brown (10YR 4/4) clay loam; moderate fine subangular blocky structure; firm; common fine roots; common fine tubular pores; few distinct dark brown (10YR 3/3) organic stains on faces of peds; common fine and coarse prominent very pale brown (10YR 8/2) carbonate masses; common fine distinct strong brown (7.5YR 5/6) relict redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; about 2 percent fine gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk2—23 to 32 inches; yellowish brown (10YR 5/4) clay loam; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; firm; few fine roots; few fine tubular pores; common fine prominent very pale brown (10YR 8/2) carbonate masses; common fine distinct strong brown (7.5YR 5/6) relict redoximorphic concentrations; about 2 percent fine gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

Bk3—32 to 43 inches; yellowish brown (10YR 5/4) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few fine roots; few fine tubular pores; common fine prominent very pale brown (10YR 8/2) carbonate masses; common fine distinct strong brown (7.5YR 5/6) relict redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; about 3 percent fine gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

C1—43 to 52 inches; grayish brown (2.5Y 5/2) clay loam; massive; firm; common fine and medium prominent very pale brown (10YR 8/2) carbonate masses; common fine prominent yellowish red (5YR 4/6) relict redoximorphic concentrations; about 2 percent fine gravel; strongly effervescent; moderately alkaline; gradual smooth boundary.

C2—52 to 62 inches; grayish brown (2.5Y 5/2) clay loam; massive; firm; common fine prominent very pale brown (10YR 8/2) carbonate masses; common coarse distinct yellowish brown (10YR 5/4) relict redoximorphic concentrations; about 3 percent fine gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

C3—62 to 76 inches; about 60 percent yellowish brown (10YR 5/4) and 40 percent grayish brown (2.5Y 5/2) clay loam; massive; firm; common fine prominent very pale brown (10YR 8/2) carbonate masses; common medium distinct strong brown (7.5YR 4/6) relict redoximorphic concentrations; about 2 percent fine gravel; strongly effervescent; moderately alkaline; clear smooth boundary.

C4—76 to 80 inches; grayish brown (2.5Y 5/2) clay loam; massive; firm; few fine prominent very pale brown (10YR 8/2) carbonate masses; common medium prominent yellowish brown (10YR 5/6) relict redoximorphic concentrations; about 2 percent fine gravel; strongly effervescent; moderately alkaline.

## Range in Characteristics

*Depth to carbonates:* 0 to 10 inches

*A or Ap horizon:*

Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—loam or clay loam
Reaction—neutral to moderately alkaline

*Bw horizon:*

Hue—10YR or 2.5Y
Value—4 or 5

Chroma—3 or 4
Texture—clay loam
Reaction—slightly alkaline or moderately alkaline

*Bk horizon:*
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 4
Texture—clay loam
Reaction—slightly alkaline or moderately alkaline

*C horizon:*
Hue—7.5YR to 5Y
Value—4 to 6
Chroma—1 to 6
Texture—clay loam
Reaction—slightly alkaline or moderately alkaline

## *Marshall Series*

### Typical Pedon

Marshall silty clay loam, 2 to 5 percent slopes, in a cultivated field on an interfluve; Shelby County, Iowa; 600 feet north and 1,000 feet east of the southwest corner of sec. 24, T. 79 N., R. 37 W.; USGS Kimballton topographic quadrangle; lat. 41 degrees 38 minutes 52.7 seconds N. and long. 95 degrees 06 minutes 35.2 seconds W., NAD 83:

Ap—0 to 6 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; few very fine roots; common very fine tubular pores; slightly acid; abrupt smooth boundary.

A—6 to 11 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to moderate medium granular; friable; few very fine roots; common very fine tubular pores; moderately acid; clear smooth boundary.

Bw1—11 to 19 inches; brown (10YR 4/3) silty clay loam; moderate fine subangular blocky structure; friable; few very fine roots; common very fine and fine tubular pores; many distinct very dark grayish brown (10YR 3/2) organic stains on faces of peds; moderately acid; gradual smooth boundary.

Bw2—19 to 26 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine prismatic structure parting to moderate fine and medium subangular blocky; friable; few very fine roots; many very fine tubular pores; many distinct brown (10YR 4/3) organic stains on faces of peds; moderately acid; gradual smooth boundary.

Bw3—26 to 34 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine prismatic structure parting to moderate fine and medium subangular blocky; friable; many very fine tubular pores; common fine distinct dark yellowish brown (10YR 4/6) relict redoximorphic concentrations; slightly acid; gradual smooth boundary.

Bw4—34 to 44 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; many very fine tubular pores; common fine distinct dark yellowish brown (10YR 4/6) relict redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; slightly acid; gradual smooth boundary.

BC—44 to 56 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak medium prismatic structure; friable; common very fine tubular pores; common fine distinct dark yellowish brown (10YR 4/6) relict redoximorphic concentrations; many fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; slightly acid; gradual smooth boundary.

C1—56 to 66 inches; yellowish brown (10YR 5/4) silty clay loam; massive; friable; common very fine tubular pores; many fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; many fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; slightly acid; gradual smooth boundary.

C2—66 to 80 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; common very fine tubular pores; many medium distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; many medium distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; slightly acid.

### Range in Characteristics

*Thickness of the mollic epipedon:* 10 to 24 inches
*Depth to carbonates:* More than 80 inches
*Depth to common relict redoximorphic depletions:* More than 30 inches

*Ap and A horizons:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2; 2 in pedons that have value of 3
Texture—silty clay loam or silt loam
Reaction—moderately acid to neutral

*Bw horizon:*
Hue—10YR
Value—3 to 5
Chroma—3 or 4
Texture—silty clay loam
Reaction—moderately acid or slightly acid

*BC and C horizons:*
Hue—10YR to 5Y
Value—4 or 5
Chroma—2 to 6
Texture—silt loam or silty clay loam
Reaction—slightly acid or neutral

*Taxadjunct features:* The Marshall soils in map units 9C2, 9D2, and 509D2 are taxadjuncts because the surface layer is not thick enough to meet the requirements for a mollic epipedon. These soils are classified as fine-silty, mixed, superactive, mesic Dystric Eutrudepts.

## *Minden Series*

### Typical Pedon

Minden silty clay loam, 0 to 2 percent slopes, in a cultivated field on a slightly convex slope; Cass County, Iowa; 380 feet north and 1,560 feet west of the southeast corner of sec. 31, T. 75 N., R. 37 W.; USGS Griswold topographic quadrangle; lat. 41 degrees 14 minutes 45.9 seconds N. and long. 95 degrees 08 minutes 32.2 seconds W., NAD 83:

Ap—0 to 7 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; weak very fine granular structure; friable; many very fine roots; many very fine tubular pores; moderately acid; clear smooth boundary.

A1—7 to 15 inches; black (10YR 2/1) silty clay loam, gray (10YR 4/1) dry; weak fine granular structure; friable; many very fine roots; many very fine tubular pores; moderately acid; gradual smooth boundary.

A2—15 to 22 inches; very dark grayish brown (10YR 3/2) silty clay loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure parting to weak medium granular; friable; common very fine roots; common very fine tubular pores; moderately acid; gradual smooth boundary.

Bw—22 to 32 inches; dark grayish brown (10YR 4/2) silty clay loam; weak fine subangular blocky structure; friable; common very fine roots; common very fine tubular pores; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.

Bg1—32 to 40 inches; dark grayish brown (10YR 4/2) silty clay loam; moderate fine and medium subangular blocky structure; friable; few very fine roots; common very fine tubular pores; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.

Bg2—40 to 48 inches; grayish brown (2.5Y 5/2) silty clay loam; weak fine prismatic structure parting to moderate medium subangular blocky; friable; few very fine roots; common very fine tubular pores; many coarse distinct yellowish brown (10YR 5/4) and many coarse prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.

Bg3—48 to 58 inches; grayish brown (2.5Y 5/2) silty clay loam; moderate medium subangular blocky structure; friable; common coarse distinct yellowish brown (10YR 5/4) and many coarse prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.

BCg—58 to 66 inches; grayish brown (2.5Y 5/2) silty clay loam; weak coarse subangular blocky structure; friable; common coarse distinct yellowish brown (10YR 5/4) and common coarse prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid; gradual smooth boundary.

Cg—66 to 80 inches; grayish brown (2.5Y 5/2) silt loam; massive; friable; common coarse distinct yellowish brown (10YR 5/4) and common coarse prominent yellowish brown (10YR 5/6) redoximorphic concentrations; moderately acid.

## Range in Characteristics

*Thickness of the mollic epipedon:* 16 to 24 inches
*Depth to carbonates:* More than 72 inches

*Ap or A horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

*Bw or Bg horizon:*
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2
Texture—silty clay loam
Reaction—moderately acid to neutral

*BCg horizon:*
Hue—2.5Y or 5Y

Value—4 or 5
Chroma—2 to 6
Texture—silty clay loam
Reaction—moderately acid to neutral

*Cg horizon:*
Hue—2.5Y or 5Y
Value—4 or 5
Chroma—2 to 6
Texture—silt loam
Reaction—moderately acid to neutral

## *Monona Series*

### Typical Pedon

Monona silty clay loam, 2 to 5 percent slopes, in a cultivated field on a summit in the uplands; Shelby County, Iowa; 150 feet west and 850 feet north of the southeast corner of sec. 20, T. 81 N., R. 40 W.; USGS Dunlap topographic quadrangle; lat. 41 degrees 48 minutes 26.4 seconds N. and long. 95 degrees 31 minutes 05.7 seconds W., NAD 83:

Ap—0 to 7 inches; very dark brown (10YR 2/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common fine roots; many very fine tubular pores; moderately acid; abrupt smooth boundary.

A—7 to 14 inches; about 85 percent very dark grayish brown (10YR 3/2) and 15 percent dark brown (10YR 3/3) silty clay loam, grayish brown (10YR 5/2) dry; weak very fine subangular blocky structure; friable; few very fine roots; many very fine tubular pores; many distinct very dark brown (10YR 2/2) organic stains on faces of peds; slightly acid; clear smooth boundary.

Bw1—14 to 23 inches; brown (10YR 4/3) silty clay loam; weak fine subangular blocky structure; friable; few very fine roots; many very fine tubular pores; many distinct dark brown (10YR 3/3) organic stains on faces of peds; slightly acid; gradual smooth boundary.

Bw2—23 to 35 inches; dark yellowish brown (10YR 4/4) silty clay loam; weak fine prismatic structure parting to weak fine subangular blocky; friable; few very fine roots; many very fine tubular pores; common fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; slightly acid; gradual smooth boundary.

Bw3—35 to 46 inches; dark yellowish brown (10YR 4/4) silt loam; weak medium prismatic structure parting to weak fine and medium subangular blocky; friable; many very fine tubular pores; common fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; slightly acid; gradual smooth boundary.

BC—46 to 58 inches; yellowish brown (10YR 5/4) silt loam; weak medium prismatic structure parting to weak medium subangular blocky; friable; many very fine tubular pores; common fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; neutral; gradual smooth boundary.

C—58 to 80 inches; yellowish brown (10YR 5/4) silt loam; massive; friable; many very fine tubular pores; common fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; common fine distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; neutral.

### Range in Characteristics

*Thickness of the mollic epipedon:* 10 to 24 inches
*Depth to carbonates:* More than 24 inches

*Ap or A horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 to 3
Texture—silt loam or silty clay loam
Reaction—moderately acid to neutral

*Bw horizon:*
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam or silty clay loam
Reaction—slightly acid or neutral
Note—the redoximorphic features are considered relict

*BC horizon:*
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam
Reaction—neutral or slightly alkaline
Note—the redoximorphic features are considered relict

*C horizon:*
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—silt loam
Reaction—neutral or slightly alkaline
Note—the redoximorphic features are considered relict

*Taxadjunct features:* The Monona soils in map units 10C2, 10D2, 10E2, 10F2, 100C2, 100D2, 100D3, 100E2, 100F2, 101F3, 700C2, and 700D2 are taxadjuncts because the surface layer is not thick enough to meet the requirements for a mollic epipedon. These soils are classified as fine-silty, mixed, superactive, mesic Dystric Eutrudepts.

## *Napier Series*

### Typical Pedon

Napier silt loam, 2 to 5 percent slopes, in a cultivated field in a drainageway in the uplands; Crawford County, Iowa; 280 feet south and 850 feet east of the northwest corner of sec. 30, T. 84 N., R. 41 W.; USGS Danbury topographic quadrangle; lat. 42 degrees 03 minutes 56.9 seconds N. and long. 95 degrees 40 minutes 05.1 seconds W., NAD 83:

Ap—0 to 9 inches; very dark brown (10YR 2/2) silt loam, very dark gray (10YR 3/1) dry; weak fine and medium subangular blocky structure parting to weak fine granular; friable; common very fine and fine roots; few fine tubular pores; many distinct black (10YR 2/1) organic coatings on faces of peds; slightly acid; abrupt smooth boundary.

A1—9 to 17 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine roots; common fine tubular pores; slightly acid; gradual smooth boundary.

A2—17 to 26 inches; very dark brown (10YR 2/2) silt loam, very dark grayish brown (10YR 3/2) dry; weak fine subangular blocky structure; friable; common very fine roots; common fine tubular pores; slightly acid; gradual smooth boundary.

BA—26 to 36 inches; very dark grayish brown (10YR 3/3) silt loam, dark grayish brown (10YR 4/3) dry; weak fine subangular blocky structure; friable; few very fine roots; common fine tubular pores; many distinct dark brown (10YR 3/2) organic coatings on faces of peds and on surfaces along pores; slightly acid; gradual smooth boundary.

Bw1—36 to 47 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; few very fine roots; common fine tubular pores; common distinct very dark grayish brown (10YR 3/2) organic coatings on faces of peds and on surfaces along pores; slightly acid; gradual smooth boundary.

Bw2—47 to 61 inches; brown (10YR 4/3) silt loam; weak fine prismatic structure parting to moderate fine subangular blocky; friable; common fine tubular pores; very few distinct light brownish gray (10YR 6/2) silt coatings on faces of peds; slightly acid; gradual smooth boundary.

Bw3—61 to 71 inches; brown (10YR 4/3) silt loam; moderate fine subangular blocky structure; friable; common fine tubular pores; slightly acid; clear smooth boundary.

C—71 to 80 inches; brown (10YR 4/3) silt loam; massive; friable; neutral.

## Range in Characteristics

*Depth to carbonates:* More than 36 inches
*Thickness of the mollic epipedon:* 24 to 40 inches

*Ap or A horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silt loam
Reaction—neutral or slightly acid

*BA horizon:*
Hue—10YR
Value—3
Chroma—3
Texture—silt loam
Reaction—slightly acid to moderately alkaline

*Bw horizon:*
Hue—10YR
Value—4
Chroma—3 or 4
Texture—silt loam
Reaction—slightly acid to moderately alkaline

*C horizon:*
Hue—10YR
Value—4 or 5
Chroma—3 or 4
Texture—silt loam
Reaction—slightly acid to moderately alkaline

## *Nodaway Series*

### Typical Pedon

Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded, in a cultivated field on a flood plain; Shelby County, Iowa; 200 feet south and 1,900 feet east of the northwest corner of sec. 32, T. 78 N., R. 37 W.; USGS Prairie Rose Lake topographic quadrangle; lat. 41 degrees 31 minutes 06.3 seconds N. and long. 95 degrees 07 minutes 48.8 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) silt loam, grayish brown (10YR 5/2) dry; weak fine subangular blocky structure; friable; common fine roots; common very fine tubular pores; slightly acid; abrupt smooth boundary.

C1—7 to 29 inches; stratified very dark grayish brown (10YR 3/2) and grayish brown (10YR 5/2) silt loam; massive with thin alluvial stratification; friable; few very fine roots; common very fine tubular pores; few fine distinct brown (7.5YR 4/4) and dark yellowish brown (10YR 4/4) redoximorphic concentrations; slightly acid; gradual smooth boundary.

C2—29 to 44 inches; stratified very dark gray (10YR 3/1), grayish brown (10YR 5/2), and light brownish gray (10YR 6/2) silt loam; massive with thin alluvial stratification; friable; few very fine roots; common very fine tubular pores; common fine distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; slightly acid; abrupt wavy boundary.

2Ab1—44 to 54 inches; black (10YR 2/1) silty clay loam; moderate fine granular structure; friable; few very fine roots; common very fine tubular pores; few fine distinct dark yellowish brown (10YR 4/4) redoximorphic concentrations; slightly acid; gradual smooth boundary.

2Ab2—54 to 63 inches; very dark brown (10YR 2/2) silty clay loam; moderate fine granular structure; friable; common very fine tubular pores; very many distinct black (10YR 2/1) organic stains on faces of peds; slightly acid; gradual smooth boundary.

2Ab3—63 to 72 inches; very dark brown (10YR 2/2) silty clay loam; moderate fine prismatic structure parting to moderate fine and very fine subangular blocky; friable; common very fine tubular pores; many distinct black (10YR 2/1) organic stains on faces of peds; slightly acid; clear smooth boundary.

2Bb—72 to 80 inches; very dark grayish brown (10YR 3/2) silty clay loam; moderate fine prismatic structure parting to moderate fine subangular blocky; friable; common very fine tubular pores; common distinct very dark brown (10YR 2/2) organic stains on faces of peds; slightly acid.

### Range in Characteristics

*Depth to buried soil:* More than 36 inches

*Ap or A horizon:*
Hue—10YR
Value—3
Chroma—1 or 2
Texture—silt loam
Reaction—slightly acid or neutral

*C horizon:*
Hue—10YR
Value—2 to 6
Chroma—1 or 2
Texture—silt loam or silty clay loam or stratified with these textures
Reaction—slightly acid or neutral

*2Ab horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—silty clay loam or silt loam
Reaction—slightly acid or neutral

*2Bb horizon:*
Hue—10YR
Value—3
Chroma—2
Texture—silty clay loam or silt loam
Reaction—slightly acid or neutral

## *Shelby Series*

### Typical Pedon

Shelby clay loam, in an area of Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded, in cropland in the uplands; Shelby County, Iowa; 1,900 feet west and 700 feet north of the southeast corner of sec. 27, T. 79 N., R. 37 W.; USGS Prairie Rose Lake topographic quadrangle; lat. 41 degrees 37 minutes 05.3 seconds N. and long. 95 degrees 08 minutes 18.1 seconds W., NAD 83:

Ap—0 to 7 inches; very dark grayish brown (10YR 3/2) clay loam, dark grayish brown (10YR 4/2) dry; weak fine granular structure; friable; common very fine roots; common very fine tubular pores; neutral; clear smooth boundary.

Bt1—7 to 17 inches; brown (10YR 4/3) clay loam; weak fine subangular blocky structure; firm; few very fine roots; common very fine tubular pores; few distinct brown (10YR 5/3) clay films on faces of peds; about 2 percent fine gravel; neutral; gradual smooth boundary.

Bt2—17 to 25 inches; brown (10YR 4/3) clay loam; weak fine subangular blocky structure; firm; few very fine tubular pores; few distinct brown (10YR 5/3) clay films on faces of peds; few fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; few fine faint grayish brown (2.5Y 5/2) relict redoximorphic depletions; about 2 percent fine gravel; neutral; gradual smooth boundary.

Bt3—25 to 33 inches; brown (10YR 4/3) clay loam; moderate fine prismatic structure parting to moderate fine and medium subangular blocky; firm; few very fine tubular pores; common distinct brown (10YR 5/3) clay films on faces of peds; few fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; few fine faint grayish brown (2.5Y 5/2) relict redoximorphic depletions; about 2 percent fine gravel; neutral; gradual smooth boundary.

Btk—33 to 42 inches; dark yellowish brown (10YR 4/4) clay loam; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few distinct brown (10YR 5/3) clay films on faces of peds; few very fine prominent very pale brown (10YR 8/2) carbonate nodules; common fine distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; common medium distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; about 2 percent fine gravel; slightly effervescent; slightly alkaline; gradual smooth boundary.

Bk—42 to 49 inches; dark yellowish brown (10YR 4/4) clay loam; weak fine prismatic structure parting to weak fine subangular blocky; firm; few fine prominent very pale brown (10YR 8/2) carbonate nodules; common medium distinct yellowish brown (10YR 5/6) relict redoximorphic concentrations; common medium distinct grayish brown (2.5Y 5/2) relict redoximorphic depletions; about 2 percent fine gravel; strongly effervescent; moderately alkaline; abrupt smooth boundary.

C—49 to 80 inches; light olive brown (2.5Y 5/3) clay loam; massive; firm; common medium prominent very pale brown (10YR 8/2) carbonate nodules; common coarse prominent yellowish brown (10YR 5/6) relict redoximorphic concentrations; common medium faint grayish brown (2.5Y 5/2) relict redoximorphic depletions; about 3 percent fine gravel; strongly effervescent; moderately alkaline.

### Range in Characteristics

*Depth to carbonates:* More than 30 inches

*Ap horizon:*
Hue—10YR
Value—2 or 3
Chroma—1 or 2
Texture—clay loam
Reaction—moderately acid to neutral

*Bt horizon:*
Hue—10YR
Value—4 or 5
Chroma—3 to 6
Texture—clay loam
Reaction—slightly acid or neutral

*Bk and Btk horizons (if they occur):*
Hue—10YR or 2.5Y
Value—4 or 5
Chroma—2 to 6
Texture—clay loam
Reaction—slightly alkaline or moderately alkaline

*C horizon:*
Hue—10YR or 2.5Y
Value—5
Chroma—2 or 3
Texture—clay loam
Reaction—neutral to moderately alkaline

*Taxadjunct features:* The Shelby soils in Shelby County are taxadjuncts because the surface layer is not thick enough to meet the requirements for a mollic epipedon. These soils are classified as fine-loamy, mixed, superactive, mesic Mollic Hapludalfs.

## *Zook Series*

### Typical Pedon

Zook silt loam, 0 to 2 percent slopes, occasionally flooded, overwash, in a cultivated field on a flood plain; Shelby County, Iowa; about 400 feet west and 200 feet north of the southeast corner of sec. 11, T. 78 N., R. 40 W.; USGS Shelby topographic quadrangle; lat. 41 degrees 33 minutes 52.6 seconds N. and long. 95 degrees 24 minutes 16.5 seconds W., NAD 83:

Ap—0 to 9 inches; very dark gray (10YR 3/1) silt loam, gray (10YR 5/1) dry; weak very fine subangular blocky and moderate fine granular structure; friable; common very fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

A1—9 to 18 inches; black (10YR 2/1) silty clay loam, dark gray (10YR 4/1) dry; moderate very fine subangular blocky structure; friable; common very fine roots; many very fine tubular pores; neutral; abrupt smooth boundary.

A2—18 to 23 inches; black (N 2/0) silty clay loam, very dark gray (10YR 3/1) dry; moderate fine prismatic structure parting to moderate fine subangular blocky; firm; common very fine roots; common very fine tubular pores; neutral; clear smooth boundary.

A3—23 to 29 inches; black (N 2/0) silty clay, very dark gray (10YR 3/1) dry; moderate fine prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; few very fine tubular pores; neutral; clear smooth boundary.

Bg1—29 to 46 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine roots; few very fine tubular pores; neutral; gradual smooth boundary.

Bg2—46 to 64 inches; very dark gray (10YR 3/1) silty clay, dark gray (10YR 4/1) dry; moderate medium prismatic structure parting to moderate medium subangular blocky; firm; few very fine tubular pores; few fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral; gradual smooth boundary.

Cg—64 to 80 inches; dark gray (10YR 4/1) silty clay loam; massive; firm; few very fine tubular pores; common fine prominent yellowish brown (10YR 5/6) redoximorphic concentrations; neutral.

## Range in Characteristics

*Thickness of the mollic epipedon:* More than 36 inches
*Depth to carbonates:* More than 60 inches

*Ap or A horizon:*
Hue—10YR or N; 10YR in overwash phase
Value—2 or 3; 2 or 3 in overwash phase
Chroma—0 or 1; 1 or 2 in overwash phase
Texture—silty clay loam or silty clay; silt loam in overwash phase
Reaction—moderately acid to slightly alkaline; moderately acid to slightly alkaline in overwash phase

*Bg horizon:*
Hue—10YR to 5Y
Value—2 to 5
Chroma—1
Texture—silty clay loam or silty clay
Reaction—slightly acid or neutral

*Cg horizon:*
Hue—10YR to 5Y
Value—2 to 5
Chroma—1
Texture—silty clay loam or silty clay
Reaction—slightly acid or neutral

# Formation of the Soils

In this section, the major factors of soil formation are described as they relate to the soils of Shelby County.

## Factors of Soil Formation

Soil forms through processes that act on deposited or accumulated geologic material. The characteristics of the soil at any given point are determined by the physical and mineralogical composition of the parent material; the climate under which the soil material has accumulated and existed since accumulation; the plant and animal life on and in the soil (including human activities); the relief, or lay of the land; and the length of time the forces of soil formation have acted on the soil material (Jenny, 1941).

The factors of soil formation are so closely interrelated that few generalizations can be made regarding the effect of any one factor unless conditions are specified for the others.

The soils in Shelby County formed in a variety of parent materials. The mild climate associated with a mesic temperature regime and a udic moisture regime has conditioned these parent materials, and the prairie grass ecosystem in an undulating topography has also affected the formation of the soils over geologic time. More recently, human activities have also influenced the soils in the county.

Horizons are differentiated from each other when four basic types of change take place. These changes are additions, removals, transfers, and transformations (Simonson, 1959). Each of these kinds of change affects many substances in the soils, such as organic matter, soluble salts, carbonates, sesquioxides, and silicate clay materials. Although most of these substances tend to promote horizon differentiation, others tend to offset or retard it. The processes and the resulting changes occur simultaneously in soils. The balance of these changes within the soil governs the ultimate nature of the profile.

An accumulation of organic matter generally is an early phase of horizon differentiation. It has been an important process in the differentiation of horizons in Shelby County. The amount of organic matter that has accumulated in the surface layer of the soils can range from high to very low. In some soils, because of erosion, the content of organic matter is now lower than it was in the past. In Marshall and Monona soils, for example, the organic matter content ranges from 3 to 4 percent in the slightly eroded phase; from 2 to 3 percent in the moderately eroded phase; and from 1 to 2 percent in the severely eroded phase.

### Parent Material

The soils in Shelby County formed in glacial till, paleosols, loess, alluvium, or colluvium. In general, the relationship of these parent materials is in order of geologic deposition from oldest to youngest.

Geologic events during the latter part of the Pleistocene epoch, from about 2 million to 14,000 years ago, provided a sequence of glacial drift, paleosols, and loess parent

materials. Alluvial and colluvial parent materials were deposited during geologic events dating from about 14,000 years ago to the present.

Glacial drift is a heterogeneous mixture of pulverized, sorted or unsorted rock material. Sediments were transported and deposited directly from glaciers or by meltwater streams flowing from ice sheets as the glaciers retreated. The unweathered till is firm, calcareous clay loam. It may contain pebbles, gravel, sand, silt, or clay. The depth at which carbonates occur in the profile is a significant soil property in Liston, Burchard, and Shelby soils. These soils are also referred to as “till” soils.

Soil formation occurring during the warmer interglacial stages is associated with the formation of paleosols. Clarinda and Adair soils are examples of soils that formed in paleosols. They are characterized by heavy clay. They can be several feet thick and are very slowly permeable. These soils are sometimes referred to as “gumbotil.”

Loess is fine grained material, dominantly of silt-sized particles, deposited by eolian, or windblown, processes around 24,500 to 14,000 years ago (Ruhe, 1956). The Missouri River is the assumed source for much of this sediment (Ruhe, 1969). Differences in soil properties resulting from loess deposition have profoundly affected agriculture and other land uses in Iowa (Fenton and others, 1982). Loess is mainly silt loam; soils that formed in loess have an unrestricted root zone for plants, have a high available water capacity, and generally are well aerated. Ida, Exira, Marshall, and Monona soils are examples of soils that formed in loess. The relationships of the soils on uplands in eastern Shelby County to both parent material and landform position are shown in figure 4.

The youngest, less developed soils that formed in alluvial and colluvial deposits represent some of the more fertile soils in the county. Alluvium occurs along stream channels and on flood plains. It consists of sand, silt, or clay deposited relatively recently on the land by floodwaters (from about 14,000 years ago to the present). Ackmore, Colo, Danbury, Kennebec, Nodaway, and Zook soils are examples soils that formed in alluvium.

Colluvium is soil material deposited at the base of slopes by gravity or local wash. It retains many of the characteristics of the soils from which it is washed. Judson and Napier soils formed in colluvium. These soils are on footslopes in drainageways. They have textures similar to those of the soils at the higher elevations.

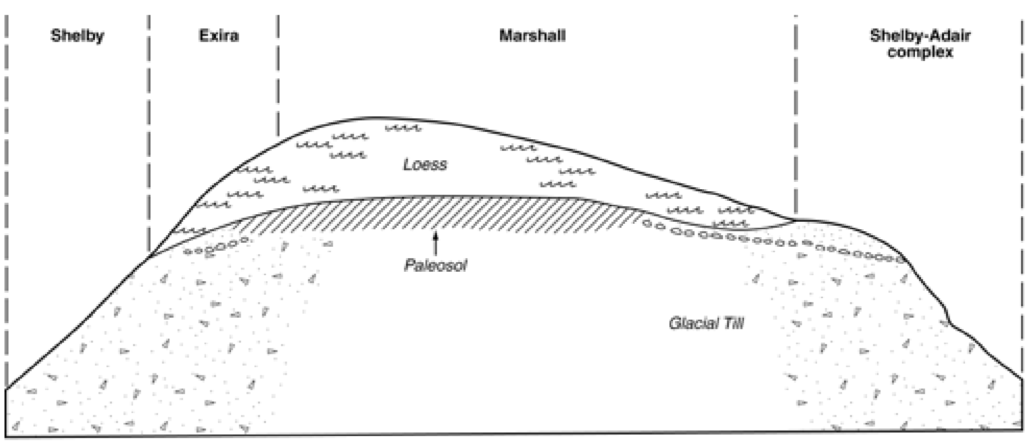


**Figure 4.—Diagram showing the relationships of the upland soils in the eastern part of Shelby County to parent material and landforms.**

## Climate

Climatic environments of the past and present have played a major role in soil development. Climate is perhaps the most influential because it determines the nature of the weathering that occurs (Brady, 1990). For example, temperature and precipitation affect the rates of chemical, physical, and biological processes responsible for profile development. The rate of biochemical reaction doubles for each 10-degree (Celsius) rise in temperature. In turn, the content of organic matter in the soil is influenced by both temperature and effective moisture. Climate also influences the natural vegetation and living organisms in a biome.

Shelby County occurs in a mesic temperature regime and a udic moisture regime. The mesic temperature regime is defined as having a mean annual soil temperature between 8 and 22 degrees C (47 to 59 degrees F). This range is common in the temperate zone. The udic moisture regime is common in humid climates that have well distributed rainfall.

Precipitation influences the communities of natural vegetation and living organisms. Various biomes have different temperatures, precipitation, or other climatic forces that act on soil material. To that extent, climate influences changes in soils that are brought about by differences in plant and animal populations.

## Living Organisms

Biological processes of living organisms greatly affect soil formation. For the purposes of this discussion, living organisms include soil organisms, burrowing organisms, vegetation, animals, and humans. Soil organisms play a major role in profile differentiation (Brady, 1990). They enhance all organic matter accumulation, profile mixing, nutrient cycling, and structural stability. Micro-organisms, such as bacteria and fungi, modify plant residues into humus and release plant nutrients. Individual genera of bacteria and fungi tend to colonize and decompose specific plant residues and to prefer specific soil temperature and moisture states (Broder and Wagner, 1988). A diversity of bacteria and fungi genera in a soil ensures that plant residues are continually decomposed, except when the soil is frozen.

Burrowing organisms, including gophers, earthworms, and crayfish, typically influence soil properties in a favorable manner. Animals, such as badgers and pocket gophers, move large amounts of soil from the subsoil to the soil surface. They are active in relatively small areas. In most places the soils appear undisturbed by burrowing animals; however, earthworms and soil insects have a widespread effect. Earthworms move up and down in soils as the soil moisture or temperature changes. In most of the soil profiles examined in the county, earthworms had moved materials from one soil horizon to another. Earthworms are beneficial in several ways. The worm channels they leave improve soil aeration and the rate of infiltration. Earthworm castings enhance the stability of soil aggregates (Shipitalo and Protz, 1988).

Historically, such prairie grasses (fig. 5) as big bluestem, with dense, fibrous root systems concentrated in the upper 12 to 15 inches of the surface, dominated the landscape (Jury and others, 1961). Timber along the major streams or in small steep areas provided habitat for wildlife. Buffalo, black bear, deer, beaver, otter, muskrat, gray fox, raccoon, mink, and wild turkey offered a variety of meat and fur sources. Ring-necked pheasant were introduced into the prairie ecosystem in the early 1900s. Woodland vegetation along streams included box elder, green ash, elm, and willow. Upland species included bur oak, red oak, shagbark hickory, walnut, and basswood. More recently, agriculture has been the dominant land use in Shelby County. Prairie grasses and native timber were supplanted by corn and soybeans. Hog, cattle, and sheep operations have replaced native bear and buffalo populations. Human activities have had the most significant impact on soils in Shelby County.

**Figure 5.—Dinesen Prairie is a native prairie nature preserve. The native grasses and forbs provide important habitat for wildlife. Pictured is a gently sloping area of Marshall soils.**

Human activity has influenced soil properties in both positive and negative ways. Some activities have had little effect on soil productivity, while others have had dramatic results. Modern conservation practices have increased the productivity of some soils for agricultural crops. Large areas of bottom land are now suitable for cultivation. Installing drainage ditches and levees has helped to minimize the effects of flooding, lowered the water table, and reduced the subsequent deposition of alluvium. Agricultural terraces, erosion-control structures, and ponds reduce the runoff rate and the hazard of erosion in the uplands. Deficiencies in plant nutrients have been improved with applications of commercial fertilizers. As a result of these combined activities, large areas on flood plains and in the uplands are now more suitable for cultivation of modern crops than they were in their native state.

Natural erosion has sculpted landforms in the uplands and built landforms in the lower areas (Soil Survey Division Staff, 1993). Erosion is the detachment of soil material by water and/or wind. It is a natural process affecting soil formation by removing all or part of the soils that formed on the landscape. Changes caused by water erosion and drainage generally are the most significant. Prior to human settlement, the loess-covered areas experienced periods of downcutting of streams, healing over, sedimentation, and repeated downcutting. This process has been accelerated as a result of certain agricultural practices.

Vegetative cover reduces the rate of natural erosion and retards the rate of removal of the mineral surface soil. Differences in the kinds of vegetation commonly result in marked differences in soil properties and development. Prairie soils generally have a higher content of organic matter than forested soils and as a result have dark colors, structural stability, and a relatively high moisture content. Breaking of the sod, removal of the protective vegetative cover, and cultivation practices reduce both fertility and the

water-holding capacity of a soils and can result in sedimentation, which is a major source of water pollution. The more sloping areas become more susceptible to sheet and gully erosion, whereas the flat areas become more susceptible to compaction.

Erosion not only has changed the thickness of the surface layer and the content of organic matter but also has changed the soil structure. Slightly eroded soils exhibit mostly granular structure in the surface layer; soil structure tends to be subangular and blocky in areas that are moderately eroded; and the surface layer is cloddy and structureless in areas that are severely eroded. The rate of surface runoff increases with increased erosion, and the rate at which water percolates into the soil decreases. As a result, on many of the cultivated soils in the county, particularly the gently rolling to hilly soils, part of the original surface layer has been lost through sheet erosion and the content of organic matter has been reduced, thereby lowering the fertility of the soils.

In places, shallow to deep gullies can form quickly; however, it takes many years for the scars to heal themselves. Gullies develop in stages that can be described as channel erosion by downward scour, headward erosion and enlargement, healing, and stabilization. Generally, headward erosion is a process of soil sloughing that works from the watercourse and up a hillside, sometimes with costly results. Bridges, roads, driveways, and building sites that parallel streams or rivers are often threatened or damaged by such erosion.

Nearly level areas, which are typically less susceptible to erosion than the more sloping areas, can be subject to compaction by heavy agricultural equipment. In fields that are cultivated continuously, the granular structure that was apparent under native grassland has been broken down. In these fields, the surface tends to crust and harden when it dries. Soils in these areas, especially when they are wet, have a tendency to puddle and are less permeable than the same type of soil in areas where traffic is managed properly.

## Topography

Topography refers to the physical features of a region relating to the configuration of the land surface described in terms of differences in elevation, slope, and relief. Elevations are highest along the northern boundary of the county and are lower along the southern boundary. The highest elevation, approximately 1,520 feet, is in Greeley Township. The lowest elevation, approximately 1,140 feet, is in Fairview Township where the Nishnabotna River flows out of Shelby County into Pottawattamie County.

Shelby County is part of an undulating plain (Jury and others, 1961). Originally, the plain was relatively smooth. Rivers and streams, however, have carved dendritic patterns on the land. The county is divided into two distinct topographic divisions: the gently rolling to rolling uplands and the nearly level, narrow valleys of streams. Most of the upland consists of gently sloping divides with rounded hills and long, smooth slopes. The upland area greatly exceeds that of the stream valleys in extent. Wet soils and the properties associated with wetness are common in low-lying places, such as on flood plains in stream valleys, but the soils in the higher areas are typically better drained (Soil Survey Division Staff, 1993).

In many places in the uplands, erosional processes have sliced through the sequence of loess, paleosols, and glacial drift parent materials and have revealed the modern catena of soils on the undulating landscape. A catena is a sequence of soils on a landscape that formed in similar kinds of parent material but have different characteristics because of differences in relief and drainage.

Relief, the variation of elevation in an area, is greatest in the northwestern part of the county. The topography of the land can hasten or delay the work of climatic forces (Brady, 1990). For example, excess water drains more slowly in flat areas than in the more rolling areas. Rolling to hilly topography encourages natural erosion of the

surface layer. In areas of steep relief, the soil material is removed before enough time has passed for the development of a thick profile with distinct horizons. Even if the soil material has been in place a long time, the horizons could still exhibit little development because much of the water runs off the slopes rather than through the soil profile. Ida soils in the western part of Shelby County are examples of loess soils that show little subsoil development because of the hilly topography.

The drainage watershed for the West Nishnabotna River covers roughly two-thirds of the eastern side of the county. The river has two main tributaries: the West Fork and the East Branch. Other tributaries include Camp, Dutch, Elk, Elkhorn, Elm, Indian, Kidds, Long Branch, Silver, Snake, Squaw, Walnut, and Willow Creeks. In the western one-third of the county, Mill and Picayune Creeks flow west into the Boyer River and Pigeon, Keg, and Mosquito Creeks ultimately flow into the Missouri River in either Pottawattamie County or Mills County.

## Time

Time is required for transformation of unconsolidated organic and mineral material into soil. Duration can directly affect formation of inherent soil properties because time enables climate and relief to alter parent materials (Brady, 1990). Generally, a long period is required for the development of distinct horizons. If other factors continue to operate over long periods, similar kinds of soils are produced from widely different kinds of parent material. Soil formation, however, generally is interrupted by geologic events that expose new parent material.

Residuum is unconsolidated, weathered mineral material that accumulated as consolidated rock disintegrated in place over a long period of time. There are no residual soils in Shelby County because the bedrock has been buried under glacial drift and loess. Relatively speaking, soils that formed in residuum derived from bedrock are older. Alluvium is more recently deposited by floodwater and streams. Soils that formed in alluvium show little or no evidence of development because they have not been in place long enough for the formation of distinct horizons. Examples of alluvial soils in Shelby County include Nodaway, Kennebec, and Colo soils. Judson and Napier soils formed in colluvium from sediments stripped from side slopes and deposited at the base or on footslopes. These soils characteristically are less developed than the soils that formed in residuum and more developed than the soils that formed in alluvium.

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# Glossary

Many of the terms relating to landforms, geology, and geomorphology are defined in more detail in the “National Soil Survey Handbook” (available in local offices of the Natural Resources Conservation Service or on the Internet).

**Ablation till.** Loose, relatively permeable earthy material deposited during the downwasting of nearly static glacial ice, either contained within or accumulated on the surface of the glacier.

**Aeration, soil.** The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

**Aggregate, soil.** Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

**Alluvium.** Unconsolidated material, such as gravel, sand, silt, clay, and various mixtures of these, deposited on land by running water.

**Alpha,alpha-dipyridyl.** A compound that when dissolved in ammonium acetate is used to detect the presence of reduced iron (Fe II) in the soil. A positive reaction implies reducing conditions and the likely presence of redoximorphic features.

**Animal unit month (AUM).** The amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

**Aquic conditions.** Current soil wetness characterized by saturation, reduction, and redoximorphic features.

**Argillic horizon.** A subsoil horizon characterized by an accumulation of illuvial clay.

**Aspect.** The direction toward which a slope faces. Also called slope aspect.

**Association, soil.** A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

**Available water capacity (available moisture capacity).** The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

| | |
|---|---|
| Very low | 0 to 3 |
| Low | 3 to 6 |
| Moderate | 6 to 9 |
| High | 9 to 12 |
| Very high | more than 12 |

**Backslope.** The position that forms the steepest and generally linear, middle portion of a hillslope (fig. 6). In profile, backslopes are commonly bounded by a convex shoulder above and a concave footslope below.

**Basal till.** Compact till deposited beneath the ice.

**Base saturation.** The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, and K), expressed as a percentage of the total cation-exchange capacity.

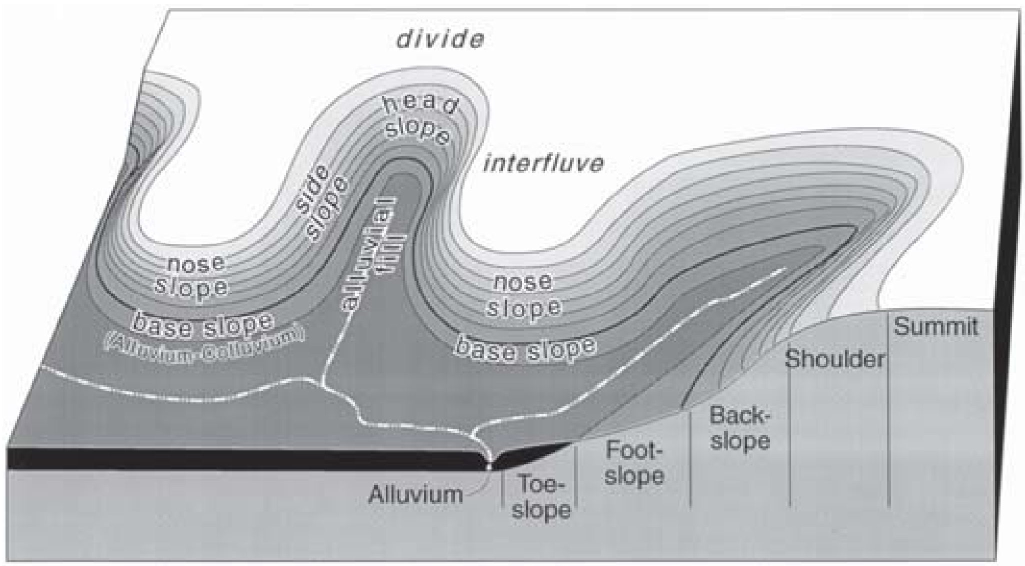


**Figure 6.—Landscape relationship of geomorphic components and hillslope positions (modified after Ruhe and Walker, 1968).**

**Base slope** (geomorphology). A geomorphic component of hills (fig. 6) consisting of the concave to linear (perpendicular to the contour) slope that, regardless of the lateral shape, forms an apron or wedge at the bottom of a hillside dominated by colluvium and slope-wash sediments (for example, slope alluvium).

**Beach deposits.** Material, such as sand and gravel, that is generally laid down parallel to an active or relict shoreline of a post-glacial or glacial lake.

**Bedding plane.** A planar or nearly planar bedding surface that visibly separates each successive layer of stratified sediment or rock (of the same or different lithology) from the preceding or following layer; a plane of deposition. It commonly marks a change in the circumstances of deposition and may show a parting, a color difference, a change in particle size, or various combinations of these. The term is commonly applied to any bedding surface, even one that is conspicuously bent or deformed by folding.

**Bedrock.** The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

**Bedrock-controlled topography.** A landscape where the configuration and relief of the landforms are determined or strongly influenced by the underlying bedrock.

**Bench terrace.** A raised, level or nearly level strip of earth constructed on or nearly on a contour, supported by a barrier of rocks or similar material, and designed to make the soil suitable for tillage and to prevent accelerated erosion.

**Bisequum.** Two sequences of soil horizons, each of which consists of an illuvial horizon and the overlying eluvial horizons.

**Blowout.** A saucer-, cup-, or trough-shaped depression formed by wind erosion on a preexisting dune or other sand deposit, especially in an area of shifting sand or loose soil or where protective vegetation is disturbed or destroyed; the adjoining accumulation of sand derived from the depression, where recognizable, is commonly included. Blowouts are commonly small.

**Bottom land.** An informal term loosely applied to various portions of a flood plain.

**Boulders.** Rock fragments larger than 2 feet (60 centimeters) in diameter.

**Brush management.** Use of mechanical, chemical, or biological methods to make conditions favorable for reseeding or to reduce or eliminate competition from woody vegetation and thus allow understory grasses and forbs to recover. Brush

management increases forage production and thus reduces the hazard of erosion. It can improve the habitat for some species of wildlife.

**Calcareous soil.** A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

**Canopy.** The leafy crown of trees or shrubs. (See Crown.)

**Capillary water.** Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

**Catena.** A sequence, or "chain," of soils on a landscape that formed in similar kinds of parent material and under similar climatic conditions but that have different characteristics as a result of differences in relief and drainage.

**Cation.** An ion carrying a positive charge of electricity. The common soil cations are calcium, potassium, magnesium, sodium, and hydrogen.

**Cation-exchange capacity.** The total amount of exchangeable cations that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. The term, as applied to soils, is synonymous with base-exchange capacity but is more precise in meaning.

**Catsteps.** See Terracettes.

**Channery soil material.** Soil material that has, by volume, 15 to 35 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 centimeters) along the longest axis. A single piece is called a channer.

**Chemical treatment.** Control of unwanted vegetation through the use of chemicals.

**Chiseling.** Tillage with an implement having one or more soil-penetrating points that shatter or loosen hard, compacted layers to a depth below normal plow depth.

**Clay.** As a soil separate, the mineral soil particles less than 0.002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

**Clay depletions.** See Redoximorphic features.

**Clay film.** A thin coating of oriented clay on the surface of a soil aggregate or lining pores or root channels. Synonyms: clay coating, clay skin.

**Claypan.** A dense, compact, slowly permeable subsoil layer that contains much more clay than the overlying materials, from which it is separated by a sharply defined boundary. A claypan is commonly hard when dry and plastic and sticky when wet.

**Climax plant community.** The stabilized plant community on a particular site. The plant cover reproduces itself and does not change so long as the environment remains the same.

**Coarse textured soil.** Sand or loamy sand.

**Cobble (or cobblestone).** A rounded or partly rounded fragment of rock 3 to 10 inches (7.6 to 25 centimeters) in diameter.

**Cobbly soil material.** Material that has 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (7.6 to 25 centimeters) in diameter. Very cobbly soil material has 35 to 60 percent of these rock fragments, and extremely cobbly soil material has more than 60 percent.

**Colluvium.** Unconsolidated, unsorted earth material being transported or deposited on side slopes and/or at the base of slopes by mass movement (e.g., direct gravitational action) and by local, unconcentrated runoff.

**Complex slope.** Irregular or variable slope. Planning or establishing terraces, diversions, and other water-control structures on a complex slope is difficult.

**Complex, soil.** A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

**Concretions.** See Redoximorphic features.

**Conservation cropping system.** Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

**Conservation tillage.** A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

**Consistence, soil.** Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and to penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. Terms describing consistence are defined in the "Soil Survey Manual."

**Contour stripcropping.** Growing crops in strips that follow the contour. Strips of grass or close-growing crops are alternated with strips of clean-tilled crops or summer fallow.

**Control section.** The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

**Coprogenous earth (sedimentary peat).** A type of limnic layer composed predominantly of fecal material derived from aquatic animals.

**Corrosion** (geomorphology). A process of erosion whereby rocks and soil are removed or worn away by natural chemical processes, especially by the solvent action of running water, but also by other reactions, such as hydrolysis, hydration, carbonation, and oxidation.

**Corrosion** (soil survey interpretations). Soil-induced electrochemical or chemical action that dissolves or weakens concrete or uncoated steel.

**Cover crop.** A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

**Crop residue management.** Returning crop residue to the soil, which helps to maintain soil structure, organic matter content, and fertility and helps to control erosion.

**Cropping system.** Growing crops according to a planned system of rotation and management practices.

**Cross-slope farming.** Deliberately conducting farming operations on sloping farmland in such a way that tillage is across the general slope.

**Crown.** The upper part of a tree or shrub, including the living branches and their foliage.

**Culmination of the mean annual increment (CMAI).** The average annual increase per acre in the volume of a stand. Computed by dividing the total volume of the stand by its age. As the stand increases in age, the mean annual increment continues to increase until mortality begins to reduce the rate of increase. The point where the stand reaches its maximum annual rate of growth is called the culmination of the mean annual increment.

**Cutbanks cave** (in tables). The walls of excavations tend to cave in or slough.

**Deferred grazing.** Postponing grazing or resting grazing land for a prescribed period.

**Delta.** A body of alluvium having a surface that is fan shaped and nearly flat; deposited at or near the mouth of a river or stream where it enters a body of relatively quiet water, generally a sea or lake.

**Dense layer** (in tables). A very firm, massive layer that has a bulk density of more than 1.8 grams per cubic centimeter. Such a layer affects the ease of digging and can affect filling and compacting.

**Depth, soil.** Generally, the thickness of the soil over bedrock. Very deep soils are more than 60 inches deep over bedrock; deep soils, 40 to 60 inches; moderately deep, 20 to 40 inches; shallow, 10 to 20 inches; and very shallow, less than 10 inches.

**Diversion (or diversion terrace).** A ridge of earth, generally a terrace, built to protect downslope areas by diverting runoff from its natural course.

**Divide.** (a) The line of separation, or (b) the summit area, or narrow tract of higher ground that constitutes the watershed boundary between two adjacent drainage basins (fig. 6); it divides the surface waters that flow naturally in one direction from those that flow in the opposite direction.

**Drainage class** (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized—*excessively drained, somewhat excessively drained, well drained, moderately well drained, somewhat poorly drained, poorly drained,* and *very poorly drained*. These classes are defined in the “Soil Survey Manual.”

**Drainage, surface.** Runoff, or surface flow of water, from an area.

**Drift.** A general term applied to all mineral material (clay, silt, sand, gravel, and boulders) transported by a glacier and deposited directly by or from the ice or transported by running water emanating from a glacier. Drift includes unstratified material (till) that forms moraines and stratified deposits that form outwash plains, eskers, kames, varves, and glaciofluvial sediments. The term is generally applied to Pleistocene glacial deposits in areas that no longer contain glaciers.

**Drumlin.** A low, smooth, elongated oval hill, mound, or ridge of compact till that has a core of bedrock or drift. It commonly has a blunt nose facing the direction from which the ice approached and a gentler slope tapering in the other direction. The longer axis is parallel to the general direction of glacier flow. Drumlins are products of streamline (laminar) flow of glaciers, which molded the subglacial floor through a combination of erosion and deposition.

**Duff.** A generally firm organic layer on the surface of mineral soils. It consists of fallen plant material that is in the process of decomposition and includes everything from the litter on the surface to underlying pure humus.

**Earthy fill.** See Mine spoil.

**Eluviation.** The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

**Endosaturation.** A type of saturation of the soil in which all horizons between the upper boundary of saturation and a depth of 2 meters are saturated.

**Eolian deposit.** Sand-, silt-, or clay-sized clastic material transported and deposited primarily by wind, commonly in the form of a dune or a sheet of sand or loess.

**Ephemeral stream.** A stream, or reach of a stream, that flows only in direct response to precipitation. It receives no long-continued supply from melting snow or other source, and its channel is above the water table at all times.

**Episaturation.** A type of saturation indicating a perched water table in a soil in which saturated layers are underlain by one or more unsaturated layers within 2 meters of the surface.

**Erosion.** The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

*Erosion* (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building

up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

*Erosion* (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

**Erosion pavement.** A surficial lag concentration or layer of gravel and other rock fragments that remains on the soil surface after sheet or rill erosion or wind has removed the finer soil particles and that tends to protect the underlying soil from further erosion.

**Escarpment.** A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. Most commonly applied to cliffs produced by differential erosion. Synonym: scarp.

**Esker.** A long, narrow, sinuous, steep-sided ridge of stratified sand and gravel deposited as the bed of a stream flowing in an ice tunnel within or below the ice (subglacial) or between ice walls on top of the ice of a wasting glacier and left behind as high ground when the ice melted. Eskers range in length from less than a kilometer to more than 160 kilometers and in height from 3 to 30 meters.

**Fertility, soil.** The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

**Fibric soil material (peat).** The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

**Field moisture capacity.** The moisture content of a soil, expressed as a percentage of the ovendry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity, normal moisture capacity,* or *capillary capacity*.

**Fine textured soil.** Sandy clay, silty clay, or clay.

**First bottom.** An obsolete, informal term loosely applied to the lowest flood-plain steps that are subject to regular flooding.

**Flaggy soil material.** Material that has, by volume, 15 to 35 percent flagstones. Very flaggy soil material has 35 to 60 percent flagstones, and extremely flaggy soil material has more than 60 percent flagstones.

**Flagstone.** A thin fragment of sandstone, limestone, slate, shale, or (rarely) schist 6 to 15 inches (15 to 38 centimeters) long.

**Flood plain.** The nearly level plain that borders a stream and is subject to flooding unless protected artificially.

**Flood-plain landforms.** A variety of constructional and erosional features produced by stream channel migration and flooding. Examples include backswamps, flood-plain splays, meanders, meander belts, meander scrolls, oxbow lakes, and natural levees.

**Flood-plain splay.** A fan-shaped deposit or other outspread deposit formed where an overloaded stream breaks through a levee (natural or artificial) and deposits its material (commonly coarse grained) on the flood plain.

**Flood-plain step.** An essentially flat, terrace-like alluvial surface within a valley that is frequently covered by floodwater from the present stream; any approximately horizontal surface still actively modified by fluvial scour and/or deposition. May occur individually or as a series of steps.

**Fluvial.** Of or pertaining to rivers or streams; produced by stream or river action.

**Footslope.** The concave surface at the base of a hillslope (fig. 6). A footslope is a transition zone between upslope sites of erosion and transport (shoulders and backslopes) and downslope sites of deposition (toeslopes).

**Forb.** Any herbaceous plant not a grass or a sedge.

**Fragipan.** A loamy, brittle subsurface horizon low in porosity and content of organic matter and low or moderate in clay but high in silt or very fine sand. A fragipan appears cemented and restricts roots. When dry, it is hard or very hard and has a higher bulk density than the horizon or horizons above. When moist, it tends to rupture suddenly under pressure rather than to deform slowly.

**Genesis, soil.** The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

**Glaciofluvial deposits.** Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur in the form of outwash plains, valley trains, deltas, kames, eskers, and kame terraces.

**Glaciolacustrine deposits.** Material ranging from fine clay to sand derived from glaciers and deposited in glacial lakes mainly by glacial meltwater. Many deposits are bedded or laminated.

**Gleyed soil.** Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors.

**Graded stripcropping.** Growing crops in strips that grade toward a protected waterway.

**Grassed waterway.** A natural or constructed waterway, typically broad and shallow, seeded to grass as protection against erosion. Conducts surface water away from cropland.

**Gravel.** Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 7.6 centimeters) in diameter. An individual piece is a pebble.

**Gravelly soil material.** Material that has 15 to 35 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (7.6 centimeters) in diameter.

**Green manure crop** (agronomy). A soil-improving crop grown to be plowed under in an early stage of maturity or soon after maturity.

**Ground water.** Water filling all the unblocked pores of the material below the water table.

**Gully.** A small channel with steep sides caused by erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. The distinction between a gully and a rill is one of depth. A gully generally is an obstacle to farm machinery and is too deep to be obliterated by ordinary tillage; a rill is of lesser depth and can be smoothed over by ordinary tillage.

**Hard bedrock.** Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

**Hard to reclaim** (in tables). Reclamation is difficult after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

**Hardpan.** A hardened or cemented soil horizon, or layer. The soil material is sandy, loamy, or clayey and is cemented by iron oxide, silica, calcium carbonate, or other substance.

**Head slope** (geomorphology). A geomorphic component of hills consisting of a laterally concave area of a hillside, especially at the head of a drainageway (fig. 6). The overland waterflow is converging.

**Hemic soil material (mucky peat).** Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

**High-residue crops.** Such crops as small grain and corn used for grain. If properly managed, residue from these crops can be used to control erosion until the next

crop in the rotation is established. These crops return large amounts of organic matter to the soil.

**Hill.** A generic term for an elevated area of the land surface, rising as much as 1,000 feet above surrounding lowlands, commonly of limited summit area and having a well defined outline. Slopes are generally more than 15 percent. The distinction between a hill and a mountain is arbitrary and may depend on local usage.

**Hillslope.** A generic term for the steeper part of a hill between its summit and the drainage line, valley flat, or depression floor at the base of a hill (fig. 6).

**Horizon, soil.** A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the “Soil Survey Manual.” The major horizons of mineral soil are as follows:

*O horizon.*—An organic layer of fresh and decaying plant residue.

*L horizon.*—A layer of organic and mineral limnic materials, including coprogenous earth (sedimentary peat), diatomaceous earth, and marl.

*A horizon.*—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

*E horizon.*—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

*B horizon.*—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

*C horizon.*—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, an Arabic numeral, commonly a 2, precedes the letter C.

*Cr horizon.*—Soft, consolidated bedrock beneath the soil.

*R layer.*—Consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon, but it can be directly below an A or a B horizon.

**Humus.** The well decomposed, more or less stable part of the organic matter in mineral soils.

**Hydrologic soil groups.** Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff.

**Ice-walled lake plain.** A relict surface marking the floor of an extinct lake basin that was formed on solid ground and surrounded by stagnant ice in a stable or unstable superglacial environment on stagnation moraines. As the ice melted, the lake plain became perched above the adjacent landscape. The lake plain is well sorted, generally fine textured, stratified deposits.

**Igneous rock.** Rock that was formed by cooling and solidification of magma and that has not been changed appreciably by weathering since its formation. Major varieties include plutonic and volcanic rock (e.g., andesite, basalt, and granite).

**Illuviation.** The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

**Impervious soil.** A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

**Infiltration.** The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

**Infiltration capacity.** The maximum rate at which water can infiltrate into a soil under a given set of conditions.

**Infiltration rate.** The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

**Intake rate.** The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application. The rate of water intake, in inches per hour, is expressed as follows:

| | |
|---|---|
| Less than 0.2 | very low |
| 0.2 to 0.4 | low |
| 0.4 to 0.75 | moderately low |
| 0.75 to 1.25 | moderate |
| 1.25 to 1.75 | moderately high |
| 1.75 to 2.5 | high |
| More than 2.5 | very high |

**Interfluve.** A landform composed of the relatively undissected upland or ridge between two adjacent valleys containing streams flowing in the same general direction. An elevated area between two drainageways that sheds water to those drainageways.

**Interfluve** (geomorphology). A geomorphic component of hills consisting of the uppermost, comparatively level or gently sloping area of a hill (fig. 6); shoulders of backwearing hillslopes can narrow the upland or can merge, resulting in a strongly convex shape.

**Intermittent stream.** A stream, or reach of a stream, that does not flow year-round but that is commonly dry for 3 or more months out of 12 and whose channel is generally below the local water table. It flows only during wet periods or when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

**Iron depletions.** See Redoximorphic features.

**Irrigation.** Application of water to soils to assist in production of crops. Methods of irrigation are:

*Basin.*—Water is applied rapidly to nearly level plains surrounded by levees or dikes.

*Border.*—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

*Controlled flooding.*—Water is released at intervals from closely spaced field ditches and distributed uniformly over the field.

*Corrugation.*—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops or in orchards so that it flows in only one direction.

*Drip (or trickle).*—Water is applied slowly and under low pressure to the surface of the soil or into the soil through such applicators as emitters, porous tubing, or perforated pipe.

*Furrow.*—Water is applied in small ditches made by cultivation implements. Furrows are used for tree and row crops.
*Sprinkler.*—Water is sprayed over the soil surface through pipes or nozzles from a pressure system.
*Subirrigation.*—Water is applied in open ditches or tile lines until the water table is raised enough to wet the soil.
*Wild flooding.*—Water, released at high points, is allowed to flow onto an area without controlled distribution.

**Kame.** A low mound, knob, hummock, or short irregular ridge composed of stratified sand and gravel deposited by a subglacial stream as a fan or delta at the margin of a melting glacier; by a supraglacial stream in a low place or hole on the surface of the glacier; or as a ponded deposit on the surface or at the margin of stagnant ice.

**Kame moraine.** An end moraine that contains numerous kames. A group of kames along the front of a stagnant glacier, commonly comprising the slumped remnants of a formerly continuous outwash plain built up over the foot of rapidly wasting or stagnant ice.

**Karst** (topography). A kind of topography that formed in limestone, gypsum, or other soluble rocks by dissolution and that is characterized by closed depressions, sinkholes, caves, and underground drainage.

**Knoll.** A small, low, rounded hill rising above adjacent landforms.

**Ksat.** Saturated hydraulic conductivity. (See Permeability.)

**Lacustrine deposit.** Material deposited in lake water and exposed when the water level is lowered or the elevation of the land is raised.

**Lake bed.** The bottom of a lake; a lake basin.

**Lake plain.** A nearly level surface marking the floor of an extinct lake filled by well sorted, generally fine textured, stratified deposits, commonly containing varves.

**Lake terrace.** A narrow shelf, partly cut and partly built, produced along a lakeshore in front of a scarp line of low cliffs and later exposed when the water level falls.

**Landslide.** A general, encompassing term for most types of mass movement landforms and processes involving the downslope transport and outward deposition of soil and rock materials caused by gravitational forces; the movement may or may not involve saturated materials. The speed and distance of movement, as well as the amount of soil and rock material, vary greatly.

**Large stones** (in tables). Rock fragments 3 inches (7.6 centimeters) or more across. Large stones adversely affect the specified use of the soil.

**Leaching.** The removal of soluble material from soil or other material by percolating water.

**Linear extensibility.** Refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. Linear extensibility is used to determine the shrink-swell potential of soils. It is an expression of the volume change between the water content of the clod at $^1/_3$- or $^1/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. Volume change is influenced by the amount and type of clay minerals in the soil. The volume change is the percent change for the whole soil. If it is expressed as a fraction, the resulting value is COLE, coefficient of linear extensibility.

**Liquid limit.** The moisture content at which the soil passes from a plastic to a liquid state.

**Loam.** Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

**Loess.** Material transported and deposited by wind and consisting dominantly of silt-sized particles.

**Low strength.** The soil is not strong enough to support loads.

**Low-residue crops.** Such crops as corn used for silage, peas, beans, and potatoes. Residue from these crops is not adequate to control erosion until the next crop in the rotation is established. These crops return little organic matter to the soil.

**Marl.** An earthy, unconsolidated deposit consisting chiefly of calcium carbonate mixed with clay in approximately equal proportions; formed primarily under freshwater lacustrine conditions but also formed in more saline environments.

**Masses.** See Redoximorphic features.

**Meander belt.** The zone within which migration of a meandering channel occurs; the flood-plain area included between two imaginary lines drawn tangential to the outer bends of active channel loops.

**Meander scar.** A crescent-shaped, concave or linear mark on the face of a bluff or valley wall, produced by the lateral erosion of a meandering stream that impinged upon and undercut the bluff.

**Meander scroll.** One of a series of long, parallel, close-fitting, crescent-shaped ridges and troughs formed along the inner bank of a stream meander as the channel migrated laterally down-valley and toward the outer bank.

**Mechanical treatment.** Use of mechanical equipment for seeding, brush management, and other management practices.

**Medium textured soil.** Very fine sandy loam, loam, silt loam, or silt.

**Metamorphic rock.** Rock of any origin altered in mineralogical composition, chemical composition, or structure by heat, pressure, and movement at depth in the earth's crust. Nearly all such rocks are crystalline.

**Mine spoil.** An accumulation of displaced earthy material, rock, or other waste material removed during mining or excavation. Also called earthy fill.

**Mineral soil.** Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

**Minimum tillage.** Only the tillage essential to crop production and prevention of soil damage.

**Miscellaneous area.** A kind of map unit that has little or no natural soil and supports little or no vegetation.

**MLRA (major land resource area).** A geographic area characterized by a particular pattern of land uses, elevation and topography, soils, climate, water resources, and potential natural vegetation.

**Moderately coarse textured soil.** Coarse sandy loam, sandy loam, or fine sandy loam.

**Moderately fine textured soil.** Clay loam, sandy clay loam, or silty clay loam.

**Mollic epipedon.** A thick, dark, humus-rich surface horizon (or horizons) that has high base saturation and pedogenic soil structure. It may include the upper part of the subsoil.

**Moraine.** In terms of glacial geology, a mound, ridge, or other topographically distinct accumulation of unsorted, unstratified drift, predominantly till, deposited primarily by the direct action of glacial ice in a variety of landforms. Also, a general term for a landform composed mainly of till (except for kame moraines, which are composed mainly of stratified outwash) that has been deposited by a glacier. Some types of moraines are disintegration, end, ground, kame, lateral, recessional, and terminal.

**Morphology, soil.** The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

**Mottling, soil.** Irregular spots of different colors that vary in number and size. Descriptive terms are as follows: abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates

less than 5 millimeters (about 0.2 inch); *medium,* from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse,* more than 15 millimeters (about 0.6 inch).

**Muck.** Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

**Mudstone.** A blocky or massive, fine grained sedimentary rock in which the proportions of clay and silt are approximately equal. Also, a general term for such material as clay, silt, claystone, siltstone, shale, and argillite and that should be used only when the amounts of clay and silt are not known or cannot be precisely identified.

**Munsell notation.** A designation of color by degrees of three simple variables—hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

**Natric horizon.** A special kind of argillic horizon that contains enough exchangeable sodium to have an adverse effect on the physical condition of the subsoil.

**Neutral soil.** A soil having a pH value of 6.6 to 7.3. (See Reaction, soil.)

**Nodules.** See Redoximorphic features.

**Nose slope** (geomorphology). A geomorphic component of hills consisting of the projecting end (laterally convex area) of a hillside (fig. 6). The overland waterflow is predominantly divergent. Nose slopes consist dominantly of colluvium and slope-wash sediments (for example, slope alluvium).

**Nutrient, plant.** Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

**Organic matter.** Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

| | |
|---|---|
| Very low | less than 0.5 percent |
| Low | 0.5 to 1.0 percent |
| Moderately low | 1.0 to 2.0 percent |
| Moderate | 2.0 to 4.0 percent |
| High | 4.0 to 8.0 percent |
| Very high | more than 8.0 percent |

**Outwash.** Stratified and sorted sediments (chiefly sand and gravel) removed or “washed out” from a glacier by meltwater streams and deposited in front of or beyond the end moraine or the margin of a glacier. The coarser material is deposited nearer to the ice.

**Outwash plain.** An extensive lowland area of coarse textured glaciofluvial material. An outwash plain is commonly smooth; where pitted, it generally is low in relief.

**Paleoterrace.** An erosional remnant of a terrace that retains the surface form and alluvial deposits of its origin but was not emplaced by, and commonly does not grade to, a present-day stream or drainage network.

**Pan.** A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

**Parent material.** The unconsolidated organic and mineral material in which soil forms.

**Parts per million (ppm).** The concentration of a substance in the soil, such as phosphorus or potassium, in one million parts of air-dried soil on a weight per weight basis.

**Peat.** Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

**Ped.** An individual natural soil aggregate, such as a granule, a prism, or a block.

**Pedisediment.** A layer of sediment, eroded from the shoulder and backslope of an erosional slope, that lies on and is being (or was) transported across a gently sloping erosional surface at the foot of a receding hill or mountain slope.

**Pedon.** The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

**Percolation.** The movement of water through the soil.

**Permeability.** The quality of the soil that enables water or air to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

| | |
|---|---|
| Impermeable | less than 0.0015 inch |
| Very slow | 0.0015 to 0.06 inch |
| Slow | 0.06 to 0.2 inch |
| Moderately slow | 0.2 to 0.6 inch |
| Moderate | 0.6 inch to 2.0 inches |
| Moderately rapid | 2.0 to 6.0 inches |
| Rapid | 6.0 to 20 inches |
| Very rapid | more than 20 inches |

**pH value.** A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

**Phase, soil.** A subdivision of a soil series based on features that affect its use and management, such as slope, stoniness, and flooding.

**Phosphorus.** The amount of phosphorus available to plants at a depth of 30 to 42 inches is expressed in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available phosphorus are:

| | |
|---|---|
| Very low | less than 7.5 ppm |
| Low | 7.5 to 13.0 ppm |
| Medium | 13.0 to 22.5 ppm |
| High | more than 22.5 ppm |

**Piping** (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

**Pitted outwash plain.** An outwash plain marked by many irregular depressions, such as kettles, shallow pits, and potholes, which formed by melting of incorporated ice masses.

**Plastic limit.** The moisture content at which a soil changes from semisolid to plastic.

**Plasticity index.** The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

**Plateau** (geomorphology). A comparatively flat area of great extent and elevation; specifically, an extensive land region that is considerably elevated (more than 100 meters) above the adjacent lower lying terrain, is commonly limited on at least one side by an abrupt descent, and has a flat or nearly level surface. A comparatively large part of a plateau surface is near summit level.

**Plowpan.** A compacted layer formed in the soil directly below the plowed layer.

**Ponding.** Standing water on soils in closed depressions. Unless the soils are artificially drained, the water can be removed only by percolation or evapotranspiration.

**Poorly graded.** Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

**Pore linings.** See Redoximorphic features.

**Potassium.** The amount of potassium available to plants at a depth of 12 to 24 inches is expressed in parts per million and based on the weighted average of air-dried soil samples. Terms describing the amount of available potassium are:

| | |
|---|---|
| Very low | less than 50 ppm |
| Low | 50 to 79 ppm |
| Medium | 79 to 125 ppm |
| High | more than 125 ppm |

**Potential native plant community.** See Climax plant community.

**Potential rooting depth (effective rooting depth).** Depth to which roots could penetrate if the content of moisture in the soil were adequate. The soil has no properties restricting the penetration of roots to this depth.

**Prescribed burning.** Deliberately burning an area for specific management purposes, under the appropriate conditions of weather and soil moisture and at the proper time of day.

**Productivity, soil.** The capability of a soil for producing a specified plant or sequence of plants under specific management.

**Profile, soil.** A vertical section of the soil extending through all its horizons and into the parent material.

**Reaction, soil.** A measure of acidity or alkalinity of a soil, expressed as pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

| | |
|---|---|
| Ultra acid | less than 3.5 |
| Extremely acid | 3.5 to 4.4 |
| Very strongly acid | 4.5 to 5.0 |
| Strongly acid | 5.1 to 5.5 |
| Moderately acid | 5.6 to 6.0 |
| Slightly acid | 6.1 to 6.5 |
| Neutral | 6.6 to 7.3 |
| Slightly alkaline | 7.4 to 7.8 |
| Moderately alkaline | 7.9 to 8.4 |
| Strongly alkaline | 8.5 to 9.0 |
| Very strongly alkaline | 9.1 and higher |

**Redoximorphic concentrations.** See Redoximorphic features.

**Redoximorphic depletions.** See Redoximorphic features.

**Redoximorphic features.** Redoximorphic features are associated with wetness and result from alternating periods of reduction and oxidation of iron and manganese compounds in the soil. Reduction occurs during saturation with water, and oxidation occurs when the soil is not saturated. Characteristic color patterns are created by these processes. The reduced iron and manganese ions may be removed from a soil if vertical or lateral fluxes of water occur, in which case there is no iron or manganese precipitation in that soil. Wherever the iron and manganese are oxidized and precipitated, they form either soft masses or hard concretions or nodules. Movement of iron and manganese as a result of redoximorphic processes in a soil may result in redoximorphic features that are defined as follows:

1. Redoximorphic concentrations.—These are zones of apparent accumulation of iron-manganese oxides, including:
   A. Nodules and concretions, which are cemented bodies that can be removed from the soil intact. Concretions are distinguished from nodules on the basis of internal organization. A concretion typically has concentric layers that are visible to the naked eye. Nodules do not have visible organized internal structure; *and*
   B. Masses, which are noncemented concentrations of substances within the soil matrix; *and*
   C. Pore linings, i.e., zones of accumulation along pores that may be either coatings on pore surfaces or impregnations from the matrix adjacent to the pores.
2. Redoximorphic depletions.—These are zones of low chroma (chromas less than those in the matrix) where either iron-manganese oxides alone or both iron-manganese oxides and clay have been stripped out, including:
   A. Iron depletions, i.e., zones that contain low amounts of iron and manganese oxides but have a clay content similar to that of the adjacent matrix; *and*
   B. Clay depletions, i.e., zones that contain low amounts of iron, manganese, and clay (often referred to as silt coatings or skeletans).
3. Reduced matrix.—This is a soil matrix that has low chroma *in situ* but undergoes a change in hue or chroma within 30 minutes after the soil material has been exposed to air.

**Reduced matrix.** See Redoximorphic features.

**Regolith.** All unconsolidated earth materials above the solid bedrock. It includes material weathered in place from all kinds of bedrock and alluvial, glacial, eolian, lacustrine, and pyroclastic deposits.

**Relief.** The relative difference in elevation between the upland summits and the lowlands or valleys of a given region.

**Residuum (residual soil material).** Unconsolidated, weathered or partly weathered mineral material that accumulated as bedrock disintegrated in place.

**Rill.** A very small, steep-sided channel resulting from erosion and cut in unconsolidated materials by concentrated but intermittent flow of water. A rill generally is not an obstacle to wheeled vehicles and is shallow enough to be smoothed over by ordinary tillage.

**Riser.** The vertical or steep side slope (e.g., escarpment) of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural, steplike landforms, such as successive stream terraces.

**Road cut.** A sloping surface produced by mechanical means during road construction. It is commonly on the uphill side of the road.

**Rock fragments.** Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

**Root zone.** The part of the soil that can be penetrated by plant roots.

**Runoff.** The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

**Saline soil.** A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

**Sand.** As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

**Sandstone.** Sedimentary rock containing dominantly sand-sized particles.

**Sapric soil material (muck).** The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

**Saturated hydraulic conductivity (Ksat).** See Permeability.

**Saturation.** Wetness characterized by zero or positive pressure of the soil water. Under conditions of saturation, the water will flow from the soil matrix into an unlined auger hole.

**Scarification.** The act of abrading, scratching, loosening, crushing, or modifying the surface to increase water absorption or to provide a more tillable soil.

**Second bottom.** The first terrace above the normal flood plain (or first bottom) of a river.

**Sedimentary rock.** A consolidated deposit of clastic particles, chemical precipitates, or organic remains accumulated at or near the surface of the earth under normal low temperature and pressure conditions. Sedimentary rocks include consolidated equivalents of alluvium, colluvium, drift, and eolian, lacustrine, and marine deposits. Examples are sandstone, siltstone, mudstone, claystone, shale, conglomerate, limestone, dolomite, and coal.

**Seepage** (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

**Sequum.** A sequence consisting of an illuvial horizon and the overlying eluvial horizon. (See Eluviation.)

**Series, soil.** A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

**Shale.** Sedimentary rock that formed by the hardening of a deposit of clay, silty clay, or silty clay loam and that has a tendency to split into thin layers.

**Sheet erosion.** The removal of a fairly uniform layer of soil material from the land surface by the action of rainfall and surface runoff.

**Shoulder.** The convex, erosional surface near the top of a hillslope (fig. 6). A shoulder is a transition from summit to backslope.

**Shrink-swell** (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

**Side slope** (geomorphology). A geomorphic component of hills consisting of a laterally planar area of a hillside (fig. 6). The overland waterflow is predominantly parallel. Side slopes are dominantly colluvium and slope-wash sediments.

**Silica.** A combination of silicon and oxygen. The mineral form is called quartz.

**Silt.** As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

**Siltstone.** An indurated silt having the texture and composition of shale but lacking its fine lamination or fissility; a massive mudstone in which silt predominates over clay.

**Similar soils.** Soils that share limits of diagnostic criteria, behave and perform in a similar manner, and have similar conservation needs or management requirements for the major land uses in the survey area.

**Sinkhole.** A closed, circular or elliptical depression, commonly funnel shaped, characterized by subsurface drainage and formed either by dissolution of the surface of underlying bedrock (e.g., limestone, gypsum, or salt) or by collapse of underlying caves within bedrock. Complexes of sinkholes in carbonate-rock terrain are the main components of karst topography.

**Slickensides** (pedogenic). Grooved, striated, and/or glossy (shiny) slip faces on structural peds, such as wedges; produced by shrink-swell processes, most commonly in soils that have a high content of expansive clays.

**Slope.** The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

**Slope** (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

**Slope alluvium.** Sediment gradually transported down the slopes of mountains or hills primarily by nonchannel alluvial processes (i.e., slope-wash processes) and characterized by particle sorting. Lateral particle sorting is evident on long slopes. In a profile sequence, sediments may be distinguished by differences in size and/ or specific gravity of rock fragments and may be separated by stone lines. Burnished peds and sorting of rounded or subrounded pebbles or cobbles distinguish these materials from unsorted colluvial deposits.

**Slow refill** (in tables). The slow filling of ponds, resulting from restricted permeability in the soil.

**Sodium adsorption ratio (SAR).** A measure of the amount of sodium (Na) relative to calcium (Ca) and magnesium (Mg) in the water extract from saturated soil paste. It is the ratio of the Na concentration divided by the square root of one-half of the Ca + Mg concentration.

**Soft bedrock.** Bedrock that can be excavated with trenching machines, backhoes, small rippers, and other equipment commonly used in construction.

**Soil.** A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief and by the passage of time.

**Soil separates.** Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

| | |
|---|---|
| Very coarse sand | 2.0 to 1.0 |
| Coarse sand | 1.0 to 0.5 |
| Medium sand | 0.5 to 0.25 |
| Fine sand | 0.25 to 0.10 |
| Very fine sand | 0.10 to 0.05 |
| Silt | 0.05 to 0.002 |
| Clay | less than 0.002 |

**Solum.** The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the material below the solum. The living roots and plant and animal activities are largely confined to the solum.

**Stagnation moraine.** A body of drift released by the melting of a glacier that ceased flowing. Commonly but not always occurs near ice margins; composed of till, ice-contact stratified drift, and small areas of glacial lake sediment. Typical landforms are knob-and-kettle topography, locally including ice-walled lake plains.

**Stone line.** In a vertical cross section, a line formed by scattered fragments or a discrete layer of angular and subangular rock fragments (commonly a gravel- or cobble-sized lag concentration) that formerly was draped across a topographic surface and was later buried by additional sediments. A stone line generally caps material that was subject to weathering, soil formation, and erosion before burial.

Many stone lines seem to be buried erosion pavements, originally formed by sheet and rill erosion across the land surface.

**Stones.** Rock fragments 10 to 24 inches (25 to 60 centimeters) in diameter if rounded or 15 to 24 inches (38 to 60 centimeters) in length if flat.

**Stony.** Refers to a soil containing stones in numbers that interfere with or prevent tillage.

**Strath terrace.** A type of stream terrace; formed as an erosional surface cut on bedrock and thinly mantled with stream deposits (alluvium).

**Stream terrace.** One of a series of platforms in a stream valley, flanking and more or less parallel to the stream channel, originally formed near the level of the stream; represents the remnants of an abandoned flood plain, stream bed, or valley floor produced during a former state of fluvial erosion or deposition.

**Stripcropping.** Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind erosion and water erosion.

**Structure, soil.** The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

**Stubble mulch.** Stubble or other crop residue left on the soil or partly worked into the soil. It protects the soil from wind erosion and water erosion after harvest, during preparation of a seedbed for the next crop, and during the early growing period of the new crop.

**Subglacial.** Formed or accumulated in or by the bottom parts of a glacier or ice sheet.

**Subsoil.** Technically, the B horizon; roughly, the part of the solum below plow depth.

**Subsoiling.** Tilling a soil below normal plow depth, ordinarily to shatter a hardpan or claypan.

**Substratum.** The part of the soil below the solum.

**Subsurface layer.** Any surface soil horizon (A, E, AB, or EB) below the surface layer.

**Summit.** The topographically highest position of a hillslope (fig. 6). It has a nearly level (planar or only slightly convex) surface.

**Surface layer.** The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

**Surface soil.** The A, E, AB, and EB horizons, considered collectively. It includes all subdivisions of these horizons.

**Swale.** A slight depression in the midst of generally level land. A shallow depression in an undulating ground moraine caused by uneven glacial deposition.

**Taxadjuncts.** Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior. Soils are recognized as taxadjuncts only when one or more of their characteristics are slightly outside the range defined for the family of the series for which the soils are named.

**Terminal moraine.** An end moraine that marks the farthest advance of a glacier. It typically has the form of a massive arcuate or concentric ridge, or complex of ridges, and is underlain by till and other types of drift.

**Terrace** (conservation). An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field generally is built so that the field can be farmed. A terrace intended mainly for drainage has a deep channel that is maintained in permanent sod.

**Terrace** (geomorphology). A steplike surface, bordering a valley floor or shoreline, that represents the former position of a flood plain, lake, or seashore. The term is usually applied both to the relatively flat summit surface (tread) that was cut or built by stream or wave action and to the steeper descending slope (scarp or riser) that has graded to a lower base level of erosion.

**Terracettes.** Small, irregular steplike forms on steep hillslopes, especially in pasture, formed by creep or erosion of surficial materials that may be induced or enhanced by trampling of livestock, such as sheep or cattle.

**Texture, soil.** The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

**Till.** Dominantly unsorted and nonstratified drift, generally unconsolidated and deposited directly by a glacier without subsequent reworking by meltwater, and consisting of a heterogeneous mixture of clay, silt, sand, gravel, stones, and boulders; rock fragments of various lithologies are embedded within a finer matrix that can range from clay to sandy loam.

**Till plain.** An extensive area of level to gently undulating soils underlain predominantly by till and bounded at the distal end by subordinate recessional or end moraines.

**Tilth, soil.** The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

**Toeslope.** The gently inclined surface at the base of a hillslope (fig. 6). Toeslopes in profile are commonly gentle and linear and are constructional surfaces forming the lower part of a hillslope continuum that grades to valley or closed-depression floors.

**Topsoil.** The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

**Trace elements.** Chemical elements, for example, zinc, cobalt, manganese, copper, and iron, in soils in extremely small amounts. They are essential to plant growth.

**Tread.** The flat to gently sloping, topmost, laterally extensive slope of terraces, flood-plain steps, or other stepped landforms; commonly a recurring part of a series of natural steplike landforms, such as successive stream terraces.

**Upland.** An informal, general term for the higher ground of a region, in contrast with a low-lying adjacent area, such as a valley or plain, or for land at a higher elevation than the flood plain or low stream terrace; land above the footslope zone of the hillslope continuum.

**Valley fill.** The unconsolidated sediment deposited by any agent (water, wind, ice, or mass wasting) so as to fill or partly fill a valley.

**Variegation.** Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage.

**Varve.** A sedimentary layer or a lamina or sequence of laminae deposited in a body of still water within a year. Specifically, a thin pair of graded glaciolacustrine layers seasonally deposited, usually by meltwater streams, in a glacial lake or other body of still water in front of a glacier.

**Water bars.** Smooth, shallow ditches or depressional areas that are excavated at an angle across a sloping road. They are used to reduce the downward velocity of water and divert it off and away from the road surface. Water bars can easily be driven over if constructed properly.

**Weathering.** All physical disintegration, chemical decomposition, and biologically induced changes in rocks or other deposits at or near the earth's surface by

atmospheric or biologic agents or by circulating surface waters but involving essentially no transport of the altered material.

**Well graded.** Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

**Wilting point (or permanent wilting point).** The moisture content of soil, on an ovendry basis, at which a plant (specifically a sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

# NRCS Accessibility Statement

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Iowa State University
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Iowa State University
University Extension

In cooperation with Iowa Agriculture and Home Economics Experiment Station and Cooperative Extension Service, Iowa State University; and Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship

# Soil Survey of Shelby County, Iowa

## Part II

# How To Use This Soil Survey

This survey is divided into three parts. Part I includes general information about the survey area; descriptions of the general soil map units, detailed soil map units, and soil series in the area; and a description of how the soils formed. Part II describes the use and management of the soils and the major soil properties. This part may be updated as further information about soil management becomes available. Part III includes the maps.

On the **general soil map**, the survey area is divided into groups of soils called associations. This map is useful in planning the use and management of large areas.

To find information about your area of interest, locate that area on the map, identify the name of the soil associations on the color-coded map legend, and then refer to the section **General Soil Map Units** in Part I for a general description of the soils in your area.

The detailed soil maps can be useful in planning the use and management of small areas.

To find information about your area of interest, locate that area on the **Index to Map Sheets** in Part III. Note the number of the map sheet, and turn to that sheet. Locate your area of interest on the map sheet. Note the map unit symbols that are in that area. The **Contents** in Part I lists the map units and shows the page where each map unit is described.

The **Contents** in Part II shows which table has information on a specific land use or soil property for each detailed soil map unit. Also, see the **Contents** in Part I and Part II for other sections of this publication that may address your specific needs.

This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 2003. Soil names and descriptions were approved in 2004. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 2004. The most current official data are available through the NRCS Web Soil Survey (http://soils.usda.gov).

This survey was made cooperatively by the Natural Resources Conservation Service; the Iowa Agriculture and Home Economics Experiment Station and Cooperative Extension Service, Iowa State University; and the Division of Soil Conservation, Iowa Department of Agriculture and Land Stewardship. The survey is part of the technical assistance furnished to the Shelby County Soil and Water Conservation District. Funds appropriated by Shelby County were used to defray part of the cost of the survey.



**Cover: A combination of terraces and contour farming in the Exira-Marshall-Judson association southeast of Prairie Rose State Park.**

*Additional information about the Nation's natural resources is available online from the Natural Resources Conservation Service at http://www.nrcs.usda.gov.*

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# Soil Survey of
# Shelby County, Iowa

## Introduction to Part II

This soil survey is an inventory and evaluation of the soils in the survey area. It can be used to adjust land uses to the limitations and potentials of natural resources and the environment. Also, it can help to prevent soil-related failures in land uses.

In preparing a soil survey, soil scientists, conservationists, engineers, and others collect extensive field data about the nature and behavioral characteristics of the soils. They collect data on erosion, droughtiness, flooding, and other factors that affect various soil uses and management. Field experience and collected data on soil properties and performance are used as a basis in predicting soil behavior.

This part of the soil survey includes interpretations for various uses of the soils and data on soil properties. This information can be used to plan the use and management of soils for crops and pasture or as sites for buildings, sanitary facilities, highways and other transportation systems, and parks and other recreational facilities. It can be used to identify the potentials and limitations of each soil for specific land uses and to help prevent construction failures caused by unfavorable soil properties.

Soils are rated in their natural state. No unusual modification of the soil site or material is made other than that which is considered normal practice for the rated use. Even though soils may have limitations, it is important to remember that engineers and others can modify soil features or can design or adjust the plans for a structure to compensate for most of the limitations. Most of these practices, however, are costly. The final decision in selecting a site for a particular use generally involves weighing the costs of site preparation and maintenance.

Planners and others using soil survey information can evaluate the effect of specific land uses on productivity and on the environment in all or part of the survey area. The survey can help planners to maintain or create a land use pattern in harmony with the natural soil.

Contractors can use this survey to locate sources of gravel, sand, reclamation material, roadfill, and topsoil. They can use it to identify areas where bedrock, wetness, or very firm soil layers can cause difficulty in excavation.

Health officials, highway officials, engineers, and others may also find this survey useful. The survey can help them plan the safe disposal of wastes and locate sites for pavements, sidewalks, campgrounds, playgrounds, lawns, and trees and shrubs.

The table “Classification of the Soils” is at the end of this section. Information about the system of soil taxonomy used by the Natural Resources Conservation Service is available in Part I of this publication. The extent of the map units in this survey area is shown in the table “Acreage and Proportionate Extent of the Soils.”

## Interpretive Ratings

The interpretive tables in this survey rate the soils in the survey area for various uses. Many of the tables identify the limitations that affect specified uses and indicate the severity of those limitations. The ratings in these tables are both verbal and numerical.

## Rating Class Terms

Rating classes are expressed in the tables in terms that indicate the extent to which the soils are limited by all of the soil features that affect a specified use or in terms that indicate the suitability of the soils for the use. Thus, the tables may show limitation classes or suitability classes. Terms for the limitation classes are *not limited, somewhat limited,* and *very limited*. The suitability ratings are expressed as *well suited, moderately suited, poorly suited,* and *unsuited* or as *good, fair,* and *poor*.

## Numerical Ratings

Numerical ratings in the tables indicate the relative severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.00 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use and the point at which the soil feature is not a limitation. The limitations appear in order from the most limiting to the least limiting. Thus, if more than one limitation is identified, the most severe limitation is listed first and the least severe one is listed last.

Classification of the Soils

(An asterisk in the first column indicates a taxadjunct to the series. See text in Part I for a description of those characteristics that are outside the range of the series)

| Soil name | Family or higher taxonomic class |
|---|---|
| Ackmore | Fine-silty, mixed, superactive, nonacid, mesic Mollic Fluvaquents |
| *Adair | Fine, smectitic, mesic Oxyaquic Vertic Hapludalfs |
| Burchard | Fine-loamy, mixed, superactive, mesic Typic Argiudolls |
| *Clarinda | Fine, smectitic, mesic Vertic Epiaqualfs |
| Colo | Fine-silty, mixed, superactive, mesic Cumulic Endoaquolls |
| Danbury | Fine-silty, mixed, superactive, nonacid, mesic Oxyaquic Udifluvents |
| *Exira | Fine-silty, mixed, superactive, mesic Dystric Eutrudepts |
| Ida | Fine-silty, mixed, superactive, calcareous, mesic Typic Udorthents |
| Judson | Fine-silty, mixed, superactive, mesic Cumulic Hapludolls |
| Kennebec | Fine-silty, mixed, superactive, mesic Cumulic Hapludolls |
| Liston | Fine-loamy, mixed, superactive, mesic Typic Eutrudepts |
| Marshall | Fine-silty, mixed, superactive, mesic Typic Hapludolls |
| *Marshall | Fine-silty, mixed, superactive, mesic Dystric Eutrudepts |
| Minden | Fine-silty, mixed, superactive, mesic Aquic Hapludolls |
| Monona | Fine-silty, mixed, superactive, mesic Typic Hapludolls |
| *Monona | Fine-silty, mixed, superactive, mesic Dystric Eutrudepts |
| Napier | Fine-silty, mixed, superactive, mesic Cumulic Hapludolls |
| Nodaway | Fine-silty, mixed, superactive, nonacid, mesic Mollic Udifluvents |
| Shelby | Fine-loamy, mixed, superactive, mesic Typic Argiudolls |
| *Shelby | Fine-loamy, mixed, superactive, mesic Mollic Hapludalfs |
| Zook | Fine, smectitic, mesic Cumulic Vertic Endoaquolls |

Acreage and Proportionate Extent of the Soils

| Map symbol | Soil name | Acres | Percent |
|---|---|---|---|
| 1C3 | Ida silt loam, 5 to 9 percent slopes, severely eroded | 1,076 | 0.3 |
| 1D3 | Ida silt loam, 9 to 14 percent slopes, severely eroded | 6,758 | 1.8 |
| 1E3 | Ida silt loam, 14 to 20 percent slopes, severely eroded | 10,986 | 2.9 |
| 1F3 | Ida silt loam, 20 to 30 percent slopes, severely eroded | 498 | 0.1 |
| 8B | Judson silty clay loam, 2 to 5 percent slopes | 5,210 | 1.4 |
| 8C | Judson silty clay loam, 5 to 9 percent slopes | 5,976 | 1.6 |
| 9 | Marshall silty clay loam, 0 to 2 percent slopes | 5,233 | 1.4 |
| 9B | Marshall silty clay loam, 2 to 5 percent slopes | 20,779 | 5.5 |
| 9C2 | Marshall silty clay loam, 5 to 9 percent slopes, moderately eroded | 17,028 | 4.5 |
| 9D2 | Marshall silty clay loam, 9 to 14 percent slopes, moderately eroded | 13,939 | 3.7 |
| 10C2 | Monona silt loam, 5 to 9 percent slopes, moderately eroded | 473 | 0.1 |
| 10D2 | Monona silt loam, 9 to 14 percent slopes, moderately eroded | 298 | * |
| 10E2 | Monona silt loam, 14 to 20 percent slopes, moderately eroded | 409 | 0.1 |
| 10F2 | Monona silt loam, 20 to 30 percent slopes, moderately eroded | 188 | * |
| 12B | Napier silt loam, 2 to 5 percent slopes | 620 | 0.2 |
| 12C | Napier silt loam, 5 to 9 percent slopes | 295 | * |
| 24E2 | Shelby clay loam, 14 to 18 percent slopes, moderately eroded | 4,329 | 1.1 |
| 24F2 | Shelby clay loam, 18 to 25 percent slopes, moderately eroded | 1,228 | 0.3 |
| 35D2 | Liston-Burchard complex, 9 to 14 percent slopes, moderately eroded | 605 | 0.2 |
| 54 | Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded | 2,713 | 0.7 |
| 54+ | Zook silt loam, 0 to 2 percent slopes, occasionally flooded, overwash | 5,940 | 1.6 |
| 59E2 | Burchard clay loam, 14 to 18 percent slopes, moderately eroded | 1,244 | 0.3 |
| 59F2 | Burchard clay loam, 18 to 25 percent slopes, moderately eroded | 613 | 0.2 |
| 93D2 | Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded | 6,358 | 1.7 |
| 99D2 | Exira silty clay loam, 9 to 14 percent slopes, moderately eroded | 43,293 | 11.4 |
| 99E2 | Exira silty clay loam, 14 to 18 percent slopes, moderately eroded | 14,694 | 3.9 |
| 99F2 | Exira silty clay loam, 18 to 25 percent slopes, moderately eroded | 2,353 | 0.6 |
| 100B | Monona silty clay loam, 2 to 5 percent slopes | 14,840 | 3.9 |
| 100C2 | Monona silty clay loam, 5 to 9 percent slopes, moderately eroded | 12,908 | 3.4 |
| 100D2 | Monona silty clay loam, 9 to 14 percent slopes, moderately eroded | 33,197 | 8.8 |
| 100D3 | Monona silty clay loam, 9 to 14 percent slopes, severely eroded | 10,806 | 2.9 |
| 100E2 | Monona silty clay loam, 14 to 20 percent slopes, moderately eroded | 15,310 | 4.0 |
| 100F2 | Monona silty clay loam, 20 to 30 percent slopes, moderately eroded | 3,804 | 1.0 |
| 101F3 | Monona-Ida complex, 20 to 30 percent slopes, severely eroded | 74 | * |
| 212 | Kennebec silt loam, 0 to 2 percent slopes, occasionally flooded | 4,381 | 1.2 |
| 220 | Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded | 10,192 | 2.7 |
| 222D2 | Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded | 499 | 0.1 |
| 430 | Ackmore silt loam, 0 to 2 percent slopes, occasionally flooded | 14,895 | 3.9 |
| 431B | Judson-Ackmore-Colo, overwash, complex, 1 to 5 percent slopes | 73,276 | 19.4 |
| 509 | Marshall silty clay loam, bench, 0 to 2 percent slopes | 709 | 0.2 |
| 509B | Marshall silty clay loam, bench, 2 to 5 percent slopes | 3,067 | 0.8 |
| 509C | Marshall silty clay loam, bench, 5 to 9 percent slopes | 2,051 | 0.5 |
| 509D2 | Marshall silty clay loam, bench, 9 to 14 percent slopes, moderately eroded | 1,128 | 0.3 |
| 630 | Danbury silt loam, 0 to 2 percent slopes, occasionally flooded | 89 | * |
| 700B | Monona silty clay loam, bench, 2 to 5 percent slopes | 2,014 | 0.5 |
| 700C2 | Monona silty clay loam, bench, 5 to 9 percent slopes, moderately eroded | 478 | 0.1 |
| 700D2 | Monona silty clay loam, bench, 9 to 14 percent slopes, moderately eroded | 147 | * |
| 5010 | Pits, sand and gravel | 23 | * |
| 5040 | Udorthents, loamy | 193 | * |
| 5080 | Udorthents, sanitary landfill | 41 | * |
| AW | Animal waste lagoon | 6 | * |
| SL | Sewage lagoon | 78 | * |
| W | Water | 958 | 0.3 |
| | Total | 378,300 | 100.0 |

* Less than 0.1 percent.

# Agronomy

This section provides some general information about managing the soils for crops and for hay and pasture. The Iowa corn suitability rating system and the system of land capability classification used by the Natural Resources Conservation Service are explained, and the estimated yields of the main crops and hay and pasture plants are listed for each soil. Prime farmland and other important farmlands are described, and interpretations for agricultural waste management are provided.

Planners of management systems for individual fields or farms should consider obtaining specific information from the local office of the Natural Resources Conservation Service or the Cooperative Extension Service.

## Cropland Management Considerations

The management concerns affecting the use of the detailed soil map units in the county for crops are shown in the table “Cropland Management Considerations” at the end of this section. The main concerns in managing nonirrigated cropland are conserving moisture, controlling wind erosion and water erosion, and maintaining soil fertility.

*Conserving moisture* consists primarily of reducing the evaporation and runoff rates and increasing the water infiltration rate. Applying conservation tillage and conservation cropping systems, farming on the contour, stripcropping, establishing field windbreaks, and leaving crop residue on the surface conserve moisture.

Generally, a combination of several practices is needed to control wind erosion and water erosion. Conservation tillage, stripcropping, field windbreaks, contour farming, conservation cropping systems, crop residue management, terraces, diversions, and grassed waterways help to prevent excessive soil loss.

Measures that are effective in maintaining soil fertility include applying fertilizer, both organic and inorganic, including manure; incorporating crop residue or green manure crops into the soil; and using proper crop rotations. Controlling erosion helps to prevent the loss of organic matter and plant nutrients and thus helps to maintain productivity, although the level of fertility can be reduced even in areas where erosion is controlled. All soils used for nonirrigated crops respond well to applications of fertilizer.

Some of the considerations shown in the table cannot be easily overcome. These are channels, flooding, gullies, and ponding.

Additional considerations are as follows:

*Lime content, limited available water capacity, limited content of organic matter, potential poor tilth and compaction, and restricted permeability.*—These limitations can be minimized by incorporating green manure crops, manure, or crop residue into the soil; applying a system of conservation tillage; and using conservation cropping systems. Also, crops may respond well to additions of phosphate fertilizer to soils that have a high content of lime.

*Potential for ground-water contamination.*—The proper use of nutrients and pesticides can reduce the risk of ground-water contamination.

*Potential for surface-water contamination.*—The risk of surface-water contamination can be reduced by the proper use of nutrients and pesticides and by conservation farming practices that reduce the runoff rate.

*Surface crusting.*—This limitation retards seedling development after periods of heavy rainfall.

*Surface rock fragments.*—This limitation causes rapid wear of tillage equipment. It cannot be easily overcome.

*Surface stones.*—Stones or boulders on or near the surface can hinder normal tillage unless they are removed.

*Salt content.*—In areas where this is a limitation, only salt-tolerant crops should be grown.

On irrigated soils the main management concerns are efficient water use, nutrient management, control of erosion, pest and weed control, and timely planting and harvesting for a successful crop. An irrigation system that provides optimum control and distribution of water at minimum cost is needed. Overirrigation wastes water, leaches plant nutrients, and causes erosion. Also, it can increase wetness and soil salinity.

### Explanation of Criteria

*Acid soil.*—The pH is less than 6.1.

*Channeled.*—The word “channeled” is included in the map unit name.

*Dense layer.*—The bulk density is 1.80 g/cc or greater within the soil profile.

*Depth to rock.*—The depth to bedrock is less than 40 inches.

*Eroded.*—The word “eroded” is included in the map unit name.

*Excessive permeability.*—Saturated hydraulic conductivity is 42 micrometers per second or more within the soil profile.

*Flooding.*—Flooding is occasional, frequent, or very frequent.

*Gullied.*—The word “gullied” is included in the map unit name.

*High content of organic matter.*—The surface layer has more than 20 percent organic matter.

*Lime content.*—The pH is 7.4 or more in the surface layer, or the wind erodibility group is 4L.

*Limited available water capacity.*—The available water capacity calculated to a depth of 60 inches or to a root-limiting layer is 6 inches or less.

*Limited content of organic matter.*—The content of organic matter is 2 percent or less in the surface layer.

*Ponding.*—Ponding duration is assigned to the map unit component. Water is above the surface.

*Potential poor tilth and compaction.*—The content of clay is 27 percent or more in the surface layer.

*Potential for ground-water contamination (by nutrients or pesticides).*—The depth to a seasonal high water table is 4 feet or less, the saturated hydraulic conductivity of any layer is more than 42 micrometers per second, or the depth to bedrock is less than 60 inches.

*Potential for surface-water contamination (by nutrients or pesticides).*—The map unit component is occasionally, frequently, or very frequently flooded, is subject to ponding, is assigned to hydrologic group C or D and has a slope of more than 2 percent, is assigned to hydrologic group A and has a slope of more than 6 percent, or is assigned to hydrologic group B, has a slope of 3 percent or more, and has a K factor of more than 0.17.

*Previously eroded.*—The word “eroded” is included in the map unit name.

*Restricted permeability.*—Saturated hydraulic conductivity is less than 0.42 micrometer per second within the soil profile.

*Salt content.*—The electrical conductivity is 4 or more in the surface layer or 8 or more within a depth of 30 inches.

*Slope (equipment limitation).*—The slope is more than 15 percent.

*Surface crusting.*—The content of clay is 27 percent or more and the content of organic matter is 2 percent or less in the surface layer.

*Surface rock fragments (equipment limitation).*—The terms describing the texture of the surface layer include any rock fragment modifier, except for gravelly, channery, stony, very stony, extremely stony, bouldery, very bouldery, and extremely bouldery.

*Surface stones (equipment limitation).*—The word “stony” or “bouldery” is included in the description of the surface layer, or 0.01 to 0.1 percent of the surface is covered by stones or boulders.

*Water erosion.*—Either the slope is 6 percent or more, or the slope is more than 3 percent and less than 6 percent and the surface layer is not sandy.

*Water table.*—A water table is within 2.5 feet of the surface.

*Wind erosion.*—The wind erodibility group is 1, 2, 3, or 4L.

Hydrologic groups are described under the heading “Water Features.” Erosion factors (e.g., K factor) and wind erodibility groups are described under the heading “Physical Properties.”

Cropland Management Considerations

(See text for a description of the considerations listed in this table)

| Map symbol and soil name | Pct. of map unit | Cropland management considerations |
|---|---|---|
| 1C3: | | |
| Ida, severely eroded | 80 | Lime content<br>Limited content of organic matter<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion<br>Wind erosion |
| 1D3: | | |
| Ida, severely eroded | 80 | Lime content<br>Limited content of organic matter<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion<br>Wind erosion |
| 1E3: | | |
| Ida, severely eroded | 70 | Slope<br>Lime content<br>Limited content of organic matter<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion<br>Wind erosion |
| 1F3: | | |
| Ida, severely eroded | 70 | Slope<br>Lime content<br>Limited content of organic matter<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion<br>Wind erosion |
| 8B: | | |
| Judson | 80 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Water erosion |
| 8C: | | |
| Judson | 95 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Water erosion |
| 9: | | |
| Marshall | 95 | Potential poor tilth and compaction |
| 9B: | | |
| Marshall | 100 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Water erosion |
| 9C2: | | |
| Marshall, moderately eroded | 80 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |

Cropland Management Considerations--Continued

| Map symbol and soil name | Pct. of map unit | Cropland management considerations |
|---|---|---|
| 9D2: | | |
| Marshall, moderately eroded | 70 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 10C2: | | |
| Monona, moderately eroded | 75 | Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 10D2: | | |
| Monona, moderately eroded | 60 | Limited content of organic matter<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 10E2: | | |
| Monona, moderately eroded | 40 | Slope<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 10F2: | | |
| Monona, moderately eroded | 45 | Slope<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 12B: | | |
| Napier | 90 | Potential for surface-water contamination<br>Water erosion |
| 12C: | | |
| Napier | 95 | Potential for surface-water contamination<br>Water erosion |
| 24E2: | | |
| Shelby, moderately eroded | 70 | Slope<br>Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 24F2: | | |
| Shelby, moderately eroded | 50 | Slope<br>Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 35D2: | | |
| Liston, moderately eroded | 55 | Lime content<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion<br>Wind erosion |
| Burchard, moderately eroded | 35 | Potential for surface-water contamination<br>Previously eroded<br>Water erosion |

Cropland Management Considerations--Continued

| Map symbol and soil name | Pct. of map unit | Cropland management considerations |
|---|---|---|
| 54: | | |
| Zook, occasionally flooded | 90 | Flooding<br>Potential poor tilth and compaction<br>Potential for ground-water contamination<br>Potential for surface-water contamination<br>Water table |
| 54+: | | |
| Zook, overwash, occasionally flooded | 85 | Flooding<br>Potential for ground-water contamination<br>Potential for surface-water contamination<br>Restricted permeability<br>Water table |
| 59E2: | | |
| Burchard, moderately eroded | 75 | Slope<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 59F2: | | |
| Burchard, moderately eroded | 80 | Slope<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 93D2: | | |
| Shelby, moderately eroded | 65 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| Adair, moderately eroded | 20 | Potential poor tilth and compaction<br>Potential for ground-water contamination<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion<br>Water table |
| 99D2: | | |
| Exira, moderately eroded | 50 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 99E2: | | |
| Exira, moderately eroded | 45 | Slope<br>Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 99F2: | | |
| Exira, moderately eroded | 50 | Slope<br>Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 100B: | | |
| Monona | 55 | Potential for surface-water contamination<br>Water erosion |

Cropland Management Considerations--Continued

| Map symbol and soil name | Pct. of map unit | Cropland management considerations |
|---|---|---|
| 100C2: | | |
| Monona, moderately eroded---- | 55 | Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 100D2: | | |
| Monona, moderately eroded---- | 45 | Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 100D3: | | |
| Monona, severely eroded------ | 45 | Limited content of organic matter<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 100E2: | | |
| Monona, moderately eroded---- | 45 | Slope<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 100F2: | | |
| Monona, moderately eroded---- | 55 | Slope<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 101F3: | | |
| Monona, moderately eroded---- | 40 | Slope<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| Ida, severely eroded--------- | 30 | Slope<br>Lime content<br>Limited content of organic matter<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion<br>Wind erosion |
| 212: | | |
| Kennebec, occasionally flooded-------------------- | 70 | Flooding<br>Potential for ground-water contamination<br>Potential for surface-water contamination |
| 220: | | |
| Nodaway, occasionally flooded | 75 | Flooding<br>Potential for ground-water contamination<br>Potential for surface-water contamination |
| 222D2: | | |
| Clarinda, moderately eroded-- | 70 | Potential poor tilth and compaction<br>Potential for ground-water contamination<br>Potential for surface-water contamination<br>Previously eroded<br>Restricted permeability<br>Water erosion<br>Water table |

Cropland Management Considerations--Continued

| Map symbol and soil name | Pct. of map unit | Cropland management considerations |
|---|---|---|
| 430: | | |
| Ackmore, occasionally flooded | 75 | Flooding<br>Potential for ground-water contamination<br>Potential for surface-water contamination<br>Water table |
| 431B: | | |
| Judson------------------------ | 55 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Water erosion |
| Ackmore, rarely flooded------ | 25 | Potential for ground-water contamination<br>Water table |
| Colo, overwash, frequently flooded--------------------- | 15 | Flooding<br>Potential for ground-water contamination<br>Potential for surface-water contamination<br>Water table |
| 509: | | |
| Marshall, bench-------------- | 75 | Potential poor tilth and compaction |
| 509B: | | |
| Marshall, bench-------------- | 90 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Water erosion |
| 509C: | | |
| Marshall, bench-------------- | 85 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Water erosion |
| 509D2: | | |
| Marshall, bench, moderately eroded---------------------- | 65 | Potential poor tilth and compaction<br>Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 630: | | |
| Danbury, occasionally flooded | 80 | Flooding<br>Potential for ground-water contamination<br>Potential for surface-water contamination<br>Water table |
| 700B: | | |
| Monona, bench---------------- | 75 | Potential for surface-water contamination<br>Water erosion |
| 700C2: | | |
| Monona, bench, moderately eroded---------------------- | 50 | Potential for surface-water contamination<br>Previously eroded<br>Water erosion |
| 700D2: | | |
| Monona, bench, moderately eroded---------------------- | 60 | Potential for surface-water contamination<br>Previously eroded<br>Water erosion |

Cropland Management Considerations--Continued

| Map symbol and soil name | Pct. of map unit | Cropland management considerations |
|---|---|---|
| 5010: | | |
| Pits, sand and gravel | 100 | Not applicable |
| 5040: | | |
| Udorthents, loamy | 100 | Not applicable |
| 5080: | | |
| Udorthents, sanitary landfill | 100 | Not applicable |
| AW: | | |
| Animal waste lagoon | 100 | Not applicable |
| SL: | | |
| Sewage lagoon | 100 | Not applicable |
| W: | | |
| Water | 100 | Not applicable |

# Crop Yield Estimates

The tables “Land Capability, Corn Suitability Rating, and Yields per Acre of Crops” and “Land Capability and Yields per Acre of Pasture” are described in this section. Crops other than those shown in the tables are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Natural Resources Conservation Service or the Cooperative Extension Service can provide information about the management and productivity of the soils for those crops.

## Land Capability Classification

Land capability classification shows, in a general way, the suitability of soils for most kinds of field crops. Crops that require special management are excluded. The soils are grouped according to their limitations for field crops, the risk of damage if they are used for crops, and the way they respond to management. The criteria used in grouping the soils do not include major and generally expensive landforming that would change slope, depth, or other characteristics of the soils, nor do they include possible but unlikely major reclamation projects. Capability classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for forestland or for engineering purposes.

In the capability system, soils are generally grouped at three levels—capability class, subclass, and unit.

*Capability classes*, the broadest groups, are designated by the numbers 1 through 8. The numbers indicate progressively greater limitations and narrower choices for practical use. The classes are defined as follows:

Class 1 soils have slight limitations that restrict their use.

Class 2 soils have moderate limitations that restrict the choice of plants or that require moderate conservation practices.

Class 3 soils have severe limitations that restrict the choice of plants or that require special conservation practices, or both.

Class 4 soils have very severe limitations that restrict the choice of plants or that require very careful management, or both.

Class 5 soils are subject to little or no erosion but have other limitations, impractical to remove, that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 6 soils have severe limitations that make them generally unsuitable for cultivation and that restrict their use mainly to pasture, rangeland, forestland, or wildlife habitat.

Class 7 soils have very severe limitations that make them unsuitable for cultivation and that restrict their use mainly to grazing, forestland, or wildlife habitat.

Class 8 soils and miscellaneous areas have limitations that preclude commercial plant production and that restrict their use to recreational purposes, wildlife habitat, watershed, or esthetic purposes.

*Capability subclasses* are soil groups within one class. They are designated by adding a small letter, *e, w, s,* or *c,* to the class numeral, for example, 2e. The letter *e* shows that the main hazard is the risk of erosion unless close-growing plant cover is maintained; *w* shows that water in or on the soil interferes with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c,* used in only some parts of the United States, shows that the chief limitation is climate that is very cold or very dry.

In class 1 there are no subclasses because the soils of this class have few limitations. Class 5 contains only the subclasses indicated by *w, s,* or *c* because the

soils in class 5 are subject to little or no erosion. They have other limitations that restrict their use to pasture, rangeland, forestland, or wildlife habitat.

*Capability units* are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, 2e-4 and 3e-6. These units are not given in all soil surveys.

[Reference: United States Department of Agriculture, Soil Conservation Service. 1961. Land capability classification. USDA Handbook 210.]

## Corn Suitability Rating

The corn suitability rating (CSR) system was developed in Iowa to rate the productivity of each different kind of soil for row crops. CSRs provide a relative ranking of all soils mapped in the State of Iowa. They can be used to compare the potential yield production of one soil with that of other soils. Ratings range from 5 to 100. A rating of 5 indicates severe limitations for row crop production. Soil properties and weather conditions are the dominant factors that affect productivity.

## Crop Yields

The average yields per acre that can be expected of the principal crops under a high level of management are shown in the table. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

The yields are based mainly on the experience and records of farmers, conservationists, and extension agents. Available yield data from nearby counties and results of field trials and demonstrations also are considered.

The management needed to obtain the indicated yields of the various crops depends on the kind of soil and the crop. Management can include drainage, erosion control, and protection from flooding; the proper planting and seeding rates; suitable high-yielding crop varieties; appropriate and timely tillage; control of weeds, plant diseases, and harmful insects; favorable soil reaction and optimum levels of nitrogen, phosphorus, potassium, and trace elements for each crop; effective use of crop residue, barnyard manure, and green manure crops; and harvesting that ensures the smallest possible loss.

The estimated yields reflect the productive capacity of each soil for each of the principal crops. Yields are likely to increase as new production technology is developed. The productivity of a given soil compared with that of other soils, however, is not likely to change.

## Pasture Yields

Some pasture yields are expressed in the table in terms of animal unit months. An animal unit month (AUM) is the amount of forage required by one mature cow of approximately 1,000 pounds weight, with or without a calf, for 1 month.

The local office of the Natural Resources Conservation Service or the Cooperative Extension Service can provide information about forage yields other than those shown in the table.

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops

(The following crop yield estimates are based on a high level of management and are determined through recent research conducted by Iowa State University. They are for nonirrigated areas. See text for additional information. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

| Map symbol and soil name | Pct. of map unit | Land capability | Corn suitability rating | Corn | Soybeans | Oats |
|---|---|---|---|---|---|---|
| | | | | Bu | Bu | Bu |
| 1C3---------------------- Ida, severely eroded | 80 | 3e | 55 | 142 | 34 | 56 |
| 1D3---------------------- Ida, severely eroded | 80 | 3e | 45 | 131 | 32 | 52 |
| 1E3---------------------- Ida, severely eroded | 70 | 4e | 35 | 113 | 27 | 43 |
| 1F3---------------------- Ida, severely eroded | 70 | 6e | 15 | --- | --- | --- |
| 8B----------------------- Judson | 80 | 2e | 83 | 185 | 49 | 80 |
| 8C----------------------- Judson | 95 | 3e | 68 | 182 | 47 | 78 |
| 9------------------------ Marshall | 95 | 1 | 88 | 189 | 50 | 83 |
| 9B----------------------- Marshall | 100 | 2e | 83 | 185 | 49 | 81 |
| 9C2---------------------- Marshall, moderately eroded | 80 | 3e | 66 | 174 | 46 | 76 |
| 9D2---------------------- Marshall, moderately eroded | 70 | 3e | 56 | 162 | 42 | 74 |
| 10C2--------------------- Monona, moderately eroded | 75 | 3e | 63 | 164 | 40 | 66 |
| 10D2--------------------- Monona, moderately eroded | 60 | 3e | 53 | 146 | 37 | 60 |
| 10E2--------------------- Monona, moderately eroded | 40 | 4e | 43 | 130 | 40 | 67 |
| 10F2--------------------- Monona, moderately eroded | 45 | 6e | 23 | --- | --- | --- |
| 12B---------------------- Napier | 90 | 2e | 80 | 162 | 44 | 72 |
| 12C---------------------- Napier | 95 | 3e | 65 | 156 | 42 | 69 |

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

| Map symbol and soil name | Pct. of map unit | Land capability | Corn suitability rating | Corn | Soybeans | Oats |
|---|---|---|---|---|---|---|
| | | | | Bu | Bu | Bu |
| 24E2---------------------<br>Shelby, moderately eroded | 70 | 4e | 36 | 91 | 37 | 60 |
| 24F2---------------------<br>Shelby, moderately eroded | 50 | 6e | 16 | --- | --- | --- |
| 35D2--------------------- | | | 40 | 123 | --- | --- |
| Liston, moderately eroded----------------- | 55 | 3e | | | | |
| Burchard, moderately eroded----------------- | 35 | 3e | | | | |
| 54-----------------------<br>Zook, occasionally flooded | 90 | 2w | 81 | 157 | 39 | 64 |
| 54+----------------------<br>Zook, overwash, occasionally flooded | 85 | 2w | 86 | 160 | 42 | 68 |
| 59E2---------------------<br>Burchard, moderately eroded | 75 | 4e | 33 | 87 | 22 | 40 |
| 59F2---------------------<br>Burchard, moderately eroded | 80 | 6e | 13 | --- | --- | --- |
| 93D2--------------------- | | | 45 | 129 | 38 | 62 |
| Shelby, moderately eroded----------------- | 65 | 3e | | | | |
| Adair, moderately eroded | 20 | 4e | | | | |
| 99D2---------------------<br>Exira, moderately eroded | 50 | 3e | 56 | 149 | 43 | 71 |
| 99E2---------------------<br>Exira, moderately eroded | 45 | 4e | 46 | 124 | 38 | 62 |
| 99F2---------------------<br>Exira, moderately eroded | 50 | 6e | 26 | --- | --- | --- |
| 100B---------------------<br>Monona | 55 | 2e | 80 | 174 | 43 | 71 |
| 100C2--------------------<br>Monona, moderately eroded | 55 | 3e | 63 | 163 | 40 | 66 |
| 100D2--------------------<br>Monona, moderately eroded | 45 | 3e | 53 | 147 | 37 | 61 |
| 100D3--------------------<br>Monona, severely eroded | 45 | 4e | 50 | 144 | 36 | 59 |
| 100E2--------------------<br>Monona, moderately eroded | 45 | 4e | 43 | 126 | 42 | 68 |

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

| Map symbol and soil name | Pct. of map unit | Land capability | Corn suitability rating | Corn | Soybeans | Oats |
|---|---|---|---|---|---|---|
| | | | | Bu | Bu | Bu |
| 100F2-------------------- Monona, moderately eroded | 55 | 6e | 23 | --- | --- | --- |
| 101F3-------------------- | | | 19 | --- | 28 | 47 |
| Monona, moderately eroded----------------- | 40 | 6e | | | | |
| Ida, severely eroded---- | 30 | 6e | | | | |
| 212--------------------- Kennebec, occasionally flooded | 70 | 1 | 88 | 194 | 51 | 84 |
| 220--------------------- Nodaway, occasionally flooded | 75 | 2w | 88 | 177 | 50 | 83 |
| 222D2-------------------- Clarinda, moderately eroded | 70 | 4e | 23 | 80 | 21 | 35 |
| 430--------------------- Ackmore, occasionally flooded | 75 | 2w | 88 | 174 | 45 | 80 |
| 431B-------------------- | | | 83 | 182 | 49 | 80 |
| Judson------------------ | 55 | 2e | | | | |
| Ackmore, rarely flooded | 25 | 2w | | | | |
| Colo, overwash, frequently flooded----- | 15 | 2w | | | | |
| 509--------------------- Marshall, bench | 75 | 1 | 88 | 190 | 50 | 83 |
| 509B-------------------- Marshall, bench | 90 | 2e | 83 | 185 | 49 | 81 |
| 509C-------------------- Marshall, bench | 85 | 2e | 68 | 180 | 47 | 80 |
| 509D2-------------------- Marshall, bench, moderately eroded | 65 | 3e | 56 | 167 | 43 | 71 |
| 630--------------------- Danbury, occasionally flooded | 80 | 2w | 85 | 178 | --- | --- |
| 700B-------------------- Monona, bench | 75 | 2e | 80 | 175 | 43 | 71 |
| 700C2-------------------- Monona, bench, moderately eroded | 50 | 3e | 63 | 166 | 40 | 66 |
| 700D2-------------------- Monona, bench, moderately eroded | 60 | 3e | 53 | 152 | 39 | 69 |

Land Capability, Corn Suitability Rating, and Yields per Acre of Crops--Continued

| Map symbol and soil name | Pct. of map unit | Land capability | Corn suitability rating | Corn | Soybeans | Oats |
|---|---|---|---|---|---|---|
| | | | | Bu | Bu | Bu |
| 5010. Pits, sand and gravel | | | | | | |
| 5040. Udorthents, loamy | | | | | | |
| 5080. Udorthents, sanitary landfill | | | | | | |
| AW. Animal waste lagoon | | | | | | |
| SL. Sewage lagoon | | | | | | |
| W. Water | | | | | | |

Land Capability and Yields per Acre of Pasture

(Yields are those that can be expected under a high level of management. They are for nonirrigated areas. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil)

| Map symbol and soil name | Pct. of map unit | Land capability | Bromegrass-alfalfa hay | Smooth bromegrass | Kentucky bluegrass | Bromegrass-alfalfa |
|---|---|---|---|---|---|---|
| | | | Tons | AUM* | AUM* | AUM* |
| 1C3: Ida, severely eroded | 80 | 3e | 4.7 | 4.6 | 2.7 | 4.8 |
| 1D3: Ida, severely eroded | 80 | 3e | 4.3 | 4.2 | 2.5 | 4.4 |
| 1E3: Ida, severely eroded | 70 | 4e | 3.6 | 3.5 | 2.1 | 3.6 |
| 1F3: Ida, severely eroded | 70 | 6e | 3.2 | 3.2 | 1.9 | 3.2 |
| 8B: Judson | 80 | 2e | 6.1 | 6.0 | 3.6 | 11.2 |
| 8C: Judson | 95 | 3e | 5.9 | 5.8 | 3.5 | 10.8 |
| 9: Marshall | 95 | 1 | 6.3 | 6.2 | 3.7 | 10.7 |
| 9B: Marshall | 100 | 2e | 6.2 | 6.0 | 3.5 | 10.5 |
| 9C2: Marshall, moderately eroded | 80 | 3e | 5.8 | 5.7 | 3.4 | 9.9 |
| 9D2: Marshall, moderately eroded | 70 | 3e | 5.0 | 5.0 | 2.9 | 8.3 |
| 10C2: Monona, moderately eroded | 75 | 3e | 5.6 | 5.5 | 3.3 | 5.6 |
| 10D2: Monona, moderately eroded | 60 | 3e | 5.2 | 5.1 | 3.1 | 5.2 |
| 10E2: Monona, moderately eroded | 40 | 4e | 5.1 | 5.2 | 3.0 | 8.7 |
| 10F2: Monona, moderately eroded | 45 | 6e | 4.5 | 4.4 | 2.6 | 7.5 |
| 12B: Napier | 90 | 2e | 5.5 | 5.3 | 3.2 | 9.1 |
| 12C: Napier | 95 | 3e | 5.3 | 5.1 | 3.1 | 8.8 |
| 24E2: Shelby, moderately eroded | 70 | 4e | 4.6 | 5.6 | 2.7 | 8.1 |

See footnote at end of table.

Land Capability and Yields per Acre of Pasture--Continued

| Map symbol and soil name | Pct. of map unit | Land capability | Bromegrass-alfalfa hay | Smooth bromegrass | Kentucky bluegrass | Bromegrass-alfalfa |
|---|---|---|---|---|---|---|
| | | | Tons | AUM* | AUM* | AUM* |
| 24F2---------------------- Shelby, moderately eroded | 50 | 6e | 4.0 | 3.9 | 2.4 | 6.9 |
| 35D2---------------------- | | | --- | --- | --- | 2.8 |
| Liston, moderately eroded----------------- | 55 | 3e | | | | |
| Burchard, moderately eroded----------------- | 35 | 3e | | | | |
| 54------------------------ Zook, occasionally flooded | 90 | 2w | 3.8 | 5.2 | 3.1 | 6.3 |
| 54+----------------------- Zook, overwash, occasionally flooded | 85 | 2w | 3.7 | 5.1 | 3.1 | --- |
| 59E2---------------------- Burchard, moderately eroded | 75 | 4e | 2.6 | 2.7 | 1.6 | 4.4 |
| 59F2---------------------- Burchard, moderately eroded | 80 | 6e | --- | --- | --- | --- |
| 93D2---------------------- | | | 4.7 | 4.6 | 2.8 | 8.1 |
| Shelby, moderately eroded----------------- | 65 | 3e | | | | |
| Adair, moderately eroded | 20 | 4e | | | | |
| 99D2---------------------- Exira, moderately eroded | 50 | 3e | 5.4 | 5.3 | 3.2 | 8.8 |
| 99E2---------------------- Exira, moderately eroded | 45 | 4e | 4.7 | 4.6 | 2.8 | 1.6 |
| 99F2---------------------- Exira, moderately eroded | 50 | 6e | --- | --- | --- | --- |
| 100B---------------------- Monona | 55 | 2e | 6.0 | 5.8 | 3.5 | 6.0 |
| 100C2--------------------- Monona, moderately eroded | 55 | 3e | 5.6 | 5.5 | 3.3 | 5.6 |
| 100D2--------------------- Monona, moderately eroded | 45 | 3e | 5.2 | 5.1 | 3.1 | 5.2 |
| 100D3--------------------- Monona, severely eroded | 45 | 4e | 4.5 | 4.4 | 2.7 | 8.1 |
| 100E2--------------------- Monona, moderately eroded | 45 | 4e | 5.2 | 5.1 | 3.1 | 8.7 |
| 100F2--------------------- Monona, moderately eroded | 55 | 6e | --- | --- | --- | --- |

See footnote at end of table.

Land Capability and Yields per Acre of Pasture--Continued

| Map symbol and soil name | Pct. of map unit | Land capability | Bromegrass-alfalfa hay | Smooth bromegrass | Kentucky bluegrass | Bromegrass-alfalfa |
|---|---|---|---|---|---|---|
| | | | Tons | AUM* | AUM* | AUM* |
| 101F3-------------------- | | | 3.6 | 3.5 | 2.1 | 6.0 |
| Monona, moderately eroded----------------- | 40 | 6e | | | | |
| Ida, severely eroded---- | 30 | 6e | | | | |
| 212--------------------- | 70 | 1 | 6.4 | 6.2 | 3.7 | 11.4 |
| Kennebec, occasionally flooded | | | | | | |
| 220--------------------- | 75 | 2w | 6.3 | 6.2 | 3.7 | 10.7 |
| Nodaway, occasionally flooded | | | | | | |
| 222D2------------------- | 70 | 4e | 1.9 | 2.6 | 1.6 | 3.6 |
| Clarinda, moderately eroded | | | | | | |
| 430--------------------- | 75 | 2w | 5.3 | 5.5 | 3.2 | 8.9 |
| Ackmore, occasionally flooded | | | | | | |
| 431B-------------------- | | | 6.1 | 6.0 | 3.6 | 11.2 |
| Judson------------------ | 55 | 2e | | | | |
| Ackmore, rarely flooded | 25 | 2w | | | | |
| Colo, overwash, frequently flooded----- | 15 | 2w | | | | |
| 509--------------------- | 75 | 1 | 6.3 | 6.2 | 3.7 | 10.7 |
| Marshall, bench | | | | | | |
| 509B-------------------- | 90 | 2e | 6.2 | 6.0 | 3.6 | 10.5 |
| Marshall, bench | | | | | | |
| 509C-------------------- | 85 | 2e | 5.5 | 5.6 | 3.2 | 9.1 |
| Marshall, bench | | | | | | |
| 509D2------------------- | 65 | 3e | 5.4 | 5.3 | 3.2 | 9.3 |
| Marshall, bench, moderately eroded | | | | | | |
| 630--------------------- | 80 | 2w | --- | --- | 2.8 | --- |
| Danbury, occasionally flooded | | | | | | |
| 700B-------------------- | 75 | 2e | 5.3 | 5.5 | 3.1 | 8.9 |
| Monona, bench | | | | | | |
| 700C2------------------- | 50 | 3e | 5.6 | 5.5 | 3.3 | 5.6 |
| Monona, bench, moderately eroded | | | | | | |
| 700D2------------------- | 60 | 3e | 4.6 | 4.8 | 2.8 | 7.7 |
| Monona, bench, moderately eroded | | | | | | |
| 5010. | | | | | | |
| Pits, sand and gravel | | | | | | |
| 5040. | | | | | | |
| Udorthents, loamy | | | | | | |

See footnote at end of table.

Land Capability and Yields per Acre of Pasture--Continued

| Map symbol and soil name | Pct. of map unit | Land capability | Bromegrass-alfalfa hay | Smooth bromegrass | Kentucky bluegrass | Bromegrass-alfalfa |
|---|---|---|---|---|---|---|
| | | | Tons | AUM* | AUM* | AUM* |
| 5080. Udorthents, sanitary landfill | | | | | | |
| AW. Animal waste lagoon | | | | | | |
| SL. Sewage lagoon | | | | | | |
| W. Water | | | | | | |

* Animal unit month: The amount of forage required to feed one mature cow, of approximately 1,000 pounds weight, with or without a calf, for 30 days.

## Prime Farmland and Other Important Farmlands

The table "Prime Farmland and Other Important Farmlands" lists the map units in the survey area that are considered prime farmland and farmland of statewide importance. This list does not constitute a recommendation for a particular land use.

In an effort to identify the extent and location of important farmlands, the Natural Resources Conservation Service, in cooperation with other interested Federal, State, and local government organizations, has inventoried land that can be used for the production of the Nation's food supply.

*Prime farmland* is of major importance in meeting the Nation's short- and long-range needs for food and fiber. Because the supply of high-quality farmland is limited, the U.S. Department of Agriculture recognizes that responsible levels of government, as well as individuals, should encourage and facilitate the wise use of our Nation's prime farmland.

Prime farmland, as defined by the U.S. Department of Agriculture, is land that has the best combination of physical and chemical characteristics for producing food, feed, forage, fiber, and oilseed crops and is available for these uses. It could be cultivated land, pastureland, forestland, or other land, but it is not urban or built-up land or water areas. The soil quality, growing season, and moisture supply are those needed for the soil to economically produce sustained high yields of crops when proper management, including water management, and acceptable farming methods are applied. In general, prime farmland has an adequate and dependable supply of moisture from precipitation or irrigation, a favorable temperature and growing season, acceptable acidity or alkalinity, an acceptable salt and sodium content, and few or no rocks. The water supply is dependable and of adequate quality. Prime farmland is permeable to water and air. It is not excessively erodible or saturated with water for long periods, and it either is not frequently flooded during the growing season or is protected from flooding. Slope ranges mainly from 0 to 6 percent. More detailed information about the criteria for prime farmland is available at the local office of the Natural Resources Conservation Service.

A recent trend in land use in some areas has been the loss of some prime farmland to industrial and urban uses. The loss of prime farmland to other uses puts pressure on marginal lands, which generally are more erodible, droughty, and less productive and cannot be easily cultivated.

For some soils identified in the table as prime farmland, measures that overcome a hazard or limitation, such as flooding, wetness, and droughtiness, are needed. Onsite evaluation is needed to determine whether or not the hazard or limitation has been overcome by corrective measures.

In some areas, land that does not meet the criteria for prime farmland is considered to be *farmland of statewide importance* for the production of food, feed, fiber, forage, and oilseed crops. The criteria for defining and delineating farmland of statewide importance are determined by the appropriate State agencies. Generally, this land includes areas of soils that nearly meet the requirements for prime farmland and that economically produce high yields of crops when treated and managed according to acceptable farming methods. Some areas may produce as high a yield as prime farmland if conditions are favorable. Farmland of statewide importance may include tracts of land that have been designated for agriculture by State law.

Prime Farmland and Other Important Farmlands

(Only the soils considered prime or important farmland are listed. Urban or built-up areas of the soils listed are not considered prime or important farmland. If a soil is prime farmland only under certain conditions, such as "where drained," those conditions are specified)

| Map symbol | Map unit name | Farmland classification |
|---|---|---|
| 8B | Judson silty clay loam, 2 to 5 percent slopes | Prime farmland |
| 9 | Marshall silty clay loam, 0 to 2 percent slopes | Prime farmland |
| 9B | Marshall silty clay loam, 2 to 5 percent slopes | Prime farmland |
| 12B | Napier silt loam, 2 to 5 percent slopes | Prime farmland |
| 100B | Monona silty clay loam, 2 to 5 percent slopes | Prime farmland |
| 212 | Kennebec silt loam, 0 to 2 percent slopes, occasionally flooded | Prime farmland |
| 220 | Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded | Prime farmland |
| 430 | Ackmore silt loam, 0 to 2 percent slopes, occasionally flooded | Prime farmland |
| 509 | Marshall silty clay loam, bench, 0 to 2 percent slopes | Prime farmland |
| 509B | Marshall silty clay loam, bench, 2 to 5 percent slopes | Prime farmland |
| 630 | Danbury silt loam, 0 to 2 percent slopes, occasionally flooded | Prime farmland |
| 700B | Monona silty clay loam, bench, 2 to 5 percent slopes | Prime farmland |
| 1C3 | Ida silt loam, 5 to 9 percent slopes, severely eroded | Farmland of statewide importance |
| 1D3 | Ida silt loam, 9 to 14 percent slopes, severely eroded | Farmland of statewide importance |
| 1E3 | Ida silt loam, 14 to 20 percent slopes, severely eroded | Farmland of statewide importance |
| 8C | Judson silty clay loam, 5 to 9 percent slopes | Farmland of statewide importance |
| 9C2 | Marshall silty clay loam, 5 to 9 percent slopes, moderately eroded | Farmland of statewide importance |
| 9D2 | Marshall silty clay loam, 9 to 14 percent slopes, moderately eroded | Farmland of statewide importance |
| 10C2 | Monona silt loam, 5 to 9 percent slopes, moderately eroded | Farmland of statewide importance |
| 10D2 | Monona silt loam, 9 to 14 percent slopes, moderately eroded | Farmland of statewide importance |
| 10E2 | Monona silt loam, 14 to 20 percent slopes, moderately eroded | Farmland of statewide importance |
| 12C | Napier silt loam, 5 to 9 percent slopes | Farmland of statewide importance |
| 24E2 | Shelby clay loam, 14 to 18 percent slopes, moderately eroded | Farmland of statewide importance |
| 35D2 | Liston-Burchard complex, 9 to 14 percent slopes, moderately eroded | Farmland of statewide importance |
| 59E2 | Burchard clay loam, 14 to 18 percent slopes, moderately eroded | Farmland of statewide importance |
| 93D2 | Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded | Farmland of statewide importance |
| 99D2 | Exira silty clay loam, 9 to 14 percent slopes, moderately eroded | Farmland of statewide importance |
| 99E2 | Exira silty clay loam, 14 to 18 percent slopes, moderately eroded | Farmland of statewide importance |
| 100C2 | Monona silty clay loam, 5 to 9 percent slopes, moderately eroded | Farmland of statewide importance |
| 100D2 | Monona silty clay loam, 9 to 14 percent slopes, moderately eroded | Farmland of statewide importance |
| 100D3 | Monona silty clay loam, 9 to 14 percent slopes, severely eroded | Farmland of statewide importance |
| 100E2 | Monona silty clay loam, 14 to 20 percent slopes, moderately eroded | Farmland of statewide importance |
| 222D2 | Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded | Farmland of statewide importance |
| 509C | Marshall silty clay loam, bench, 5 to 9 percent slopes | Farmland of statewide importance |
| 509D2 | Marshall silty clay loam, bench, 9 to 14 percent slopes, moderately eroded | Farmland of statewide importance |
| 700C2 | Monona silty clay loam, bench, 5 to 9 percent slopes, moderately eroded | Farmland of statewide importance |
| 700D2 | Monona silty clay loam, bench, 9 to 14 percent slopes, moderately eroded | Farmland of statewide importance |

Prime Farmland and Other Important Farmlands--Continued

| Map symbol | Map unit name | Farmland classification |
|---|---|---|
| 54 | Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded | Prime farmland where drained |
| 54+ | Zook silt loam, 0 to 2 percent slopes, occasionally flooded, overwash | Prime farmland where drained |
| 431B | Judson-Ackmore-Colo, overwash, complex, 1 to 5 percent slopes | Prime farmland where drained |

## Agricultural Waste Management

The table “Agricultural Waste Management” is described in this section.

Soil properties are important considerations in areas where soils are used as sites for the treatment and disposal of organic waste and wastewater. Selection of soils with properties that favor waste management can help to prevent environmental damage.

This table shows the degree and kind of soil limitations affecting the treatment of agricultural waste, including municipal and food-processing wastewater and effluent from lagoons or storage ponds. Municipal wastewater is the waste stream from a municipality. It contains domestic waste and may contain industrial waste. It may have received primary or secondary treatment. It is rarely untreated sewage. Food-processing wastewater results from the preparation of fruits, vegetables, milk, cheese, and meats for public consumption. In places it is high in content of sodium and chloride. In the context of this table, the effluent in lagoons and storage ponds is from facilities used to treat or store food-processing wastewater or domestic or animal waste. Domestic and food-processing wastewater is very dilute, and the effluent from the facilities that treat or store it commonly is very low in content of carbonaceous and nitrogenous material; the content of nitrogen commonly ranges from 10 to 30 milligrams per liter. The wastewater from animal waste treatment lagoons or storage ponds, however, has much higher concentrations of these materials, mainly because the manure has not been diluted as much as the domestic waste. The content of nitrogen in this wastewater generally ranges from 50 to 2,000 milligrams per liter. When wastewater is applied, checks should be made to ensure that nitrogen, heavy metals, and salts are not added in excessive amounts.

The ratings in the table are for waste management systems that not only dispose of and treat organic waste or wastewater but also are beneficial to crops. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect agricultural waste management. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

*Application of manure and food-processing waste* not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. Manure is the excrement of livestock and poultry, and food-processing waste is damaged fruit and vegetables and the peelings, stems, leaves, pits, and soil particles removed in food preparation. The manure and food-processing waste are solid, slurry, or liquid. Their nitrogen content varies. A high content of nitrogen limits the application rate. Toxic or otherwise dangerous wastes, such as those mixed with the lye used in food processing, are not considered in the ratings.

The ratings are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the waste is applied, and the method by which the waste is applied. The properties that affect absorption include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a

cemented pan, and available water capacity. The properties that affect plant growth and microbial activity include reaction, the sodium adsorption ratio, salinity, and bulk density. The wind erodibility group, the soil erosion factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of waste. Permanently frozen soils are unsuitable for waste treatment.

*Application of sewage sludge* not only disposes of waste material but also can improve crop production by increasing the supply of nutrients in the soils where the material is applied. In the context of this table, sewage sludge is the residual product of the treatment of municipal sewage. The solid component consists mainly of cell mass, primarily bacteria cells that developed during secondary treatment and have incorporated soluble organics into their own bodies. The sludge has small amounts of sand, silt, and other solid debris. The content of nitrogen varies. Some sludge has constituents that are toxic to plants or hazardous to the food chain, such as heavy metals and exotic organic compounds, and should be analyzed chemically prior to use.

The content of water in the sludge ranges from about 98 percent to less than 40 percent. The sludge is considered liquid if it is more than about 90 percent water, slurry if it is about 50 to 90 percent water, and solid if it is less than about 50 percent water.

The ratings in the table are based on the soil properties that affect absorption, plant growth, microbial activity, erodibility, the rate at which the sludge is applied, and the method by which the sludge is applied. The properties that affect absorption, plant growth, and microbial activity include permeability, depth to a water table, ponding, the sodium adsorption ratio, depth to bedrock or a cemented pan, available water capacity, reaction, salinity, and bulk density. The wind erodibility group, the soil erosion factor K, and slope are considered in estimating the likelihood that wind erosion or water erosion will transport the waste material from the application site. Stones, cobbles, a water table, ponding, and flooding can hinder the application of sludge. Permanently frozen soils are unsuitable for waste treatment.

*Disposal of wastewater by irrigation* not only disposes of municipal wastewater and wastewater from food-processing plants, lagoons, and storage ponds but also can improve crop production by increasing the amount of water available to crops. The ratings in the table are based on the soil properties that affect the design, construction, management, and performance of the irrigation system. The properties that affect design and management include the sodium adsorption ratio, depth to a water table, ponding, available water capacity, permeability, slope, and flooding. The properties that affect construction include stones, cobbles, depth to bedrock or a cemented pan, depth to a water table, and ponding. The properties that affect performance include depth to bedrock or a cemented pan, bulk density, the sodium adsorption ratio, salinity, reaction, and the cation-exchange capacity, which is used to estimate the capacity of a soil to adsorb heavy metals. Permanently frozen soils are not suitable for disposal of wastewater by irrigation.

A soil feature considered in the ratings for application of manure, sewage sludge, and wastewater is depth to the top of a water table (saturated zone). During August, September, and October, this depth is generally more than 60 cm in normal years. For soils that are limited by wetness, “Nov-Jul” indicates the most problematic months of the year for application of manure, sewage sludge, and wastewater. These soils may be slow to drain and can become waterlogged and boggy during periods of heavy precipitation.

Agricultural Waste Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

| Map symbol and soil name | Pct. of map unit | Application of manure and food-processing waste: Rating class and limiting features | Value | Application of sewage sludge: Rating class and limiting features | Value | Disposal of wastewater by irrigation: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 1C3: | | | | | | | |
| Ida, severely eroded | 80 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Too steep for surface application | 0.92 |
| | | | | | | Too steep for sprinkler application | 0.02 |
| 1D3: | | | | | | | |
| Ida, severely eroded | 80 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 0.78 |
| 1E3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 1.00 |
| 1F3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for sprinkler application | 1.00 |
| | | | | | | Too steep for surface application | 1.00 |
| 8B: | | | | | | | |
| Judson-------------- | 80 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Too steep for surface application | 0.08 |
| 8C: | | | | | | | |
| Judson-------------- | 95 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Too steep for surface application | 0.92 |
| | | | | | | Too steep for sprinkler application | 0.02 |

Agricultural Waste Management--Continued

| Map symbol and soil name | Pct. of map unit | Application of manure and food-processing waste: Rating class and limiting features | Value | Application of sewage sludge: Rating class and limiting features | Value | Disposal of wastewater by irrigation: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 9: | | | | | | | |
| Marshall | 95 | Not limited | | Not limited | | Not limited | |
| 9B: | | | | | | | |
| Marshall | 100 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Too steep for surface application | 0.08 |
| 9C2: | | | | | | | |
| Marshall, moderately eroded | 80 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Too steep for surface application | 0.92 |
| | | | | | | Too steep for sprinkler application | 0.02 |
| 9D2: | | | | | | | |
| Marshall, moderately eroded | 70 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 0.78 |
| 10C2: | | | | | | | |
| Monona, moderately eroded | 75 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Too steep for surface application | 0.92 |
| | | | | | | Too steep for sprinkler application | 0.02 |
| 10D2: | | | | | | | |
| Monona, moderately eroded | 60 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 0.78 |
| 10E2: | | | | | | | |
| Monona, moderately eroded | 40 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 1.00 |

Agricultural Waste Management--Continued

| Map symbol and soil name | Pct. of map unit | Application of manure and food-processing waste: Rating class and limiting features | Value | Application of sewage sludge: Rating class and limiting features | Value | Disposal of wastewater by irrigation: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 10F2: | | | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for sprinkler application | 1.00 |
| | | | | | | Too steep for surface application | 1.00 |
| 12B: | | | | | | | |
| Napier | 90 | Very limited | | Very limited | | Very limited | |
| | | Low adsorption | 1.00 | Low adsorption | 1.00 | Low adsorption | 1.00 |
| | | | | | | Too steep for surface application | 0.08 |
| 12C: | | | | | | | |
| Napier | 95 | Very limited | | Very limited | | Very limited | |
| | | Low adsorption | 1.00 | Low adsorption | 1.00 | Low adsorption | 1.00 |
| | | | | | | Too steep for surface application | 0.92 |
| | | | | | | Too steep for sprinkler application | 0.02 |
| 24E2: | | | | | | | |
| Shelby, moderately eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for surface application | 1.00 |
| | | Slow water movement | 0.30 | Slow water movement | 0.22 | Too steep for sprinkler application | 1.00 |
| | | Too acid | 0.02 | Too acid | 0.07 | Slow water movement | 0.22 |
| 24F2: | | | | | | | |
| Shelby, moderately eroded | 50 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for sprinkler application | 1.00 |
| | | Runoff | 0.40 | Slow water movement | 0.22 | Too steep for surface application | 1.00 |
| | | Slow water movement | 0.30 | Too acid | 0.07 | Slow water movement | 0.22 |

Agricultural Waste Management--Continued

| Map symbol and soil name | Pct. of map unit | Application of manure and food-processing waste: Rating class and limiting features | Value | Application of sewage sludge: Rating class and limiting features | Value | Disposal of wastewater by irrigation: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 35D2: | | | | | | | |
| Liston, moderately eroded | 55 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | Slow water movement | 0.30 | Slow water movement | 0.22 | Too steep for sprinkler application | 0.78 |
| | | | | | | Slow water movement | 0.22 |
| Burchard, moderately eroded | 35 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | Slow water movement | 0.30 | Slow water movement | 0.22 | Too steep for sprinkler application | 0.78 |
| | | | | | | Slow water movement | 0.22 |
| 54: | | | | | | | |
| Zook, occasionally flooded | 90 | Very limited | | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 |
| | | Depth to saturated zone (Nov-Jul) | 1.00 | Flooding | 1.00 | Slow water movement | 1.00 |
| | | Flooding | 0.60 | Slow water movement | 1.00 | Flooding | 0.60 |
| 54+: | | | | | | | |
| Zook, overwash, occasionally flooded | 85 | Very limited | | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 |
| | | Depth to saturated zone (Nov-Jul) | 1.00 | Flooding | 1.00 | Slow water movement | 1.00 |
| | | Flooding | 0.60 | Slow water movement | 1.00 | Flooding | 0.60 |
| 59E2: | | | | | | | |
| Burchard, moderately eroded | 75 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for surface application | 1.00 |
| | | Slow water movement | 0.30 | Slow water movement | 0.22 | Too steep for sprinkler application | 1.00 |
| | | | | | | Slow water movement | 0.22 |

Agricultural Waste Management--Continued

| Map symbol and soil name | Pct. of map unit | Application of manure and food-processing waste | | Application of sewage sludge | | Disposal of wastewater by irrigation | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 59F2: | | | | | | | |
| Burchard, moderately eroded | 80 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for sprinkler application | 1.00 |
| | | Slow water movement | 0.30 | Slow water movement | 0.22 | Too steep for surface application | 1.00 |
| | | | | | | Slow water movement | 0.22 |
| 93D2: | | | | | | | |
| Shelby, moderately eroded | 65 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | Slow water movement | 0.30 | Slow water movement | 0.22 | Too steep for sprinkler application | 0.78 |
| | | | | | | Slow water movement | 0.22 |
| Adair, moderately eroded | 20 | Very limited | | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 |
| | | Depth to saturated zone (Nov-Jul) | 1.00 | Slow water movement | 1.00 | Too steep for surface application | 1.00 |
| | | Slope | 0.63 | Slope | 0.63 | Slow water movement | 1.00 |
| 99D2: | | | | | | | |
| Exira, moderately eroded | 50 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 0.78 |
| 99E2: | | | | | | | |
| Exira, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 1.00 |

Agricultural Waste Management--Continued

| Map symbol and soil name | Pct. of map unit | Application of manure and food-processing waste: Rating class and limiting features | Value | Application of sewage sludge: Rating class and limiting features | Value | Disposal of wastewater by irrigation: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 99F2: | | | | | | | |
| Exira, moderately eroded------------- | 50 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for sprinkler application | 1.00 |
| | | | | | | Too steep for surface application | 1.00 |
| 100B: | | | | | | | |
| Monona-------------- | 55 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Too steep for surface application | 0.08 |
| 100C2: | | | | | | | |
| Monona, moderately eroded------------- | 55 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Too steep for surface application | 0.92 |
| | | | | | | Too steep for sprinkler application | 0.02 |
| 100D2: | | | | | | | |
| Monona, moderately eroded------------- | 45 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 0.78 |
| 100D3: | | | | | | | |
| Monona, severely eroded------------- | 45 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 0.78 |
| 100E2: | | | | | | | |
| Monona, moderately eroded------------- | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 1.00 |

Agricultural Waste Management--Continued

| Map symbol and soil name | Pct. of map unit | Application of manure and food-processing waste | | Application of sewage sludge | | Disposal of wastewater by irrigation | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 100F2: | | | | | | | |
| Monona, moderately eroded------------- | 55 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for sprinkler application | 1.00 |
| | | | | | | Too steep for surface application | 1.00 |
| 101F3: | | | | | | | |
| Monona, moderately eroded------------- | 40 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for sprinkler application | 1.00 |
| | | | | | | Too steep for surface application | 1.00 |
| Ida, severely eroded | 30 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Too steep for sprinkler application | 1.00 |
| | | | | | | Too steep for surface application | 1.00 |
| 212: | | | | | | | |
| Kennebec, occasionally flooded------------ | 70 | Somewhat limited | | Very limited | | Somewhat limited | |
| | | Flooding | 0.60 | Flooding | 1.00 | Flooding | 0.60 |
| 220: | | | | | | | |
| Nodaway, occasionally flooded------------ | 75 | Somewhat limited | | Very limited | | Somewhat limited | |
| | | Flooding | 0.60 | Flooding | 1.00 | Flooding | 0.60 |
| 222D2: | | | | | | | |
| Clarinda, moderately eroded------------- | 70 | Very limited | | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Slow water movement | 1.00 | Slow water movement | 1.00 |
| | | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |

Agricultural Waste Management--Continued

| Map symbol and soil name | Pct. of map unit | Application of manure and food-processing waste | | Application of sewage sludge | | Disposal of wastewater by irrigation | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 430: | | | | | | | |
| Ackmore, occasionally flooded----------- | 75 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 |
| | | Flooding | 0.60 | Flooding | 1.00 | Flooding | 0.60 |
| 431B: | | | | | | | |
| Judson-------------- | 55 | Not limited | | Not limited | | Not limited | |
| Ackmore, rarely flooded----------- | 25 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 |
| | | | | Flooding | 0.40 | | |
| Colo, overwash, frequently flooded | 15 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 |
| | | Flooding | 1.00 | Flooding | 1.00 | Flooding | 1.00 |
| 509: | | | | | | | |
| Marshall, bench----- | 75 | Not limited | | Not limited | | Not limited | |
| 509B: | | | | | | | |
| Marshall, bench----- | 90 | Not limited | | Not limited | | Not limited | |
| 509C: | | | | | | | |
| Marshall, bench----- | 85 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Too steep for surface application | 0.92 |
| | | | | | | Too steep for sprinkler application | 0.02 |
| 509D2: | | | | | | | |
| Marshall, bench, moderately eroded-- | 65 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 0.78 |

Agricultural Waste Management--Continued

| Map symbol and soil name | Pct. of map unit | Application of manure and food-processing waste | | Application of sewage sludge | | Disposal of wastewater by irrigation | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 630: | | | | | | | |
| Danbury, occasionally flooded | 80 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone (Nov-Jul) | 1.00 | Flooding | 1.00 | Depth to saturated zone (Nov-Jul) | 1.00 |
| | | Flooding | 0.60 | Depth to saturated zone (Nov-Jul) | 1.00 | Flooding | 0.60 |
| 700B: | | | | | | | |
| Monona, bench | 75 | Not limited | | Not limited | | Not limited | |
| 700C2: | | | | | | | |
| Monona, bench, moderately eroded | 50 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Too steep for surface application | 0.92 |
| | | | | | | Too steep for sprinkler application | 0.02 |
| 700D2: | | | | | | | |
| Monona, bench, moderately eroded | 60 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Too steep for surface application | 1.00 |
| | | | | | | Too steep for sprinkler application | 0.78 |
| 5010: | | | | | | | |
| Pits, sand and gravel | 100 | Not rated | | Not rated | | Not rated | |
| 5040: | | | | | | | |
| Udorthents, loamy | 100 | Not rated | | Not rated | | Not rated | |
| 5080: | | | | | | | |
| Udorthents, sanitary landfill | 100 | Not rated | | Not rated | | Not rated | |
| AW: | | | | | | | |
| Animal waste lagoon | 100 | Not rated | | Not rated | | Not rated | |
| SL: | | | | | | | |
| Sewage lagoon | 100 | Not rated | | Not rated | | Not rated | |
| W: | | | | | | | |
| Water | 100 | Not rated | | Not rated | | Not rated | |

# Recreational Development

The titles of the tables described in this section are:

- “Camp Areas, Picnic Areas, and Playgrounds”
- “Paths, Trails, and Golf Fairways”

In the tables described in this section, the soils of the survey area are rated according to limitations that affect their suitability for recreational development. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect the recreational uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

The ratings in the tables are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewer lines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation also are important. Soils that are subject to flooding are limited for recreational uses by the duration and intensity of flooding and the season when flooding occurs. In planning recreational facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

The information in these tables can be supplemented by other information in this survey, for example, interpretations for dwellings without basements, for local roads and streets, and for septic tank absorption fields.

*Camp areas* require site preparation, such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The ratings are based on the soil properties that affect the ease of developing camp areas and the performance of the areas after development. Slope, stoniness, and depth to bedrock or a cemented pan are the main concerns affecting the development of camp areas. The soil properties that affect the performance of the areas after development are those that influence trafficability and promote the growth of vegetation, especially in heavily used areas. For good trafficability, the surface of camp areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the

surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Picnic areas* are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The ratings are based on the soil properties that affect the ease of developing picnic areas and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of picnic areas. For good trafficability, the surface of picnic areas should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Playgrounds* require soils that are nearly level, are free of stones, and can withstand intensive foot traffic. The ratings are based on the soil properties that affect the ease of developing playgrounds and that influence trafficability and the growth of vegetation after development. Slope and stoniness are the main concerns affecting the development of playgrounds. For good trafficability, the surface of the playgrounds should absorb rainfall readily, remain firm under heavy foot traffic, and not be dusty when dry. The soil properties that influence trafficability are texture of the surface layer, depth to a water table, ponding, flooding, permeability, and large stones. The soil properties that affect the growth of plants are depth to bedrock or a cemented pan, permeability, and toxic substances in the soil.

*Paths and trails* for hiking and horseback riding should require little or no slope modification through cutting and filling. The ratings are based on the soil properties that affect trafficability and erodibility. These properties are stoniness, depth to a water table, ponding, flooding, slope, and texture of the surface layer.

*Off-road motorcycle trails* require little or no site preparation. They are not covered with surfacing material or vegetation. Considerable compaction of the soil material is likely. The ratings are based on the soil properties that influence erodibility, trafficability, dustiness, and the ease of revegetation. These properties are stoniness, slope, depth to a water table, ponding, flooding, and texture of the surface layer.

*Golf fairways* are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer. The suitability of the soil for traps, tees, roughs, and greens is not considered in the ratings.

Camp Areas, Picnic Areas, and Playgrounds

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

| Map symbol and soil name | Pct. of map unit | Camp areas | | Picnic areas | | Playgrounds | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 1C3: | | | | | | | |
| Ida, severely eroded | 80 | Not limited | | Not limited | | Very limited | |
| | | | | | | Slope | 1.00 |
| 1D3: | | | | | | | |
| Ida, severely eroded | 80 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| 1E3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 1F3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 8B: | | | | | | | |
| Judson-------------- | 80 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.50 |
| 8C: | | | | | | | |
| Judson-------------- | 95 | Not limited | | Not limited | | Very limited | |
| | | | | | | Slope | 1.00 |
| 9: | | | | | | | |
| Marshall------------ | 95 | Not limited | | Not limited | | Not limited | |
| 9B: | | | | | | | |
| Marshall------------ | 100 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.50 |
| 9C2: | | | | | | | |
| Marshall, moderately eroded------------ | 80 | Not limited | | Not limited | | Very limited | |
| | | | | | | Slope | 1.00 |
| 9D2: | | | | | | | |
| Marshall, moderately eroded------------ | 70 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| 10C2: | | | | | | | |
| Monona, moderately eroded------------ | 75 | Not limited | | Not limited | | Very limited | |
| | | | | | | Slope | 1.00 |
| 10D2: | | | | | | | |
| Monona, moderately eroded------------ | 60 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |

Camp Areas, Picnic Areas, and Playgrounds--Continued

| Map symbol and soil name | Pct. of map unit | Camp areas | | Picnic areas | | Playgrounds | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 10E2: | | | | | | | |
| Monona, moderately eroded | 40 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 10F2: | | | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 12B: | | | | | | | |
| Napier | 90 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.50 |
| 12C: | | | | | | | |
| Napier | 95 | Not limited | | Not limited | | Very limited | |
| | | | | | | Slope | 1.00 |
| 24E2: | | | | | | | |
| Shelby, moderately eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.15 | Slow water movement | 0.15 | Slow water movement | 0.15 |
| | | | | | | Gravel content | 0.08 |
| 24F2: | | | | | | | |
| Shelby, moderately eroded | 50 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.15 | Slow water movement | 0.15 | Slow water movement | 0.15 |
| | | | | | | Gravel content | 0.08 |
| 35D2: | | | | | | | |
| Liston, moderately eroded | 55 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.15 | Slow water movement | 0.15 | Slow water movement | 0.15 |
| Burchard, moderately eroded | 35 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.15 | Slow water movement | 0.15 | Slow water movement | 0.15 |
| 54: | | | | | | | |
| Zook, occasionally flooded | 90 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Flooding | 1.00 | Slow water movement | 0.94 | Slow water movement | 0.94 |
| | | Slow water movement | 0.94 | | | Flooding | 0.60 |

Camp Areas, Picnic Areas, and Playgrounds--Continued

| Map symbol and soil name | Pct. of map unit | Camp areas: Rating class and limiting features | Value | Picnic areas: Rating class and limiting features | Value | Playgrounds: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 54+: | | | | | | | |
| Zook, overwash, occasionally flooded------------ | 85 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Flooding | 1.00 | Slow water movement | 0.94 | Slow water movement | 0.94 |
| | | Slow water movement | 0.94 | | | Flooding | 0.60 |
| 59E2: | | | | | | | |
| Burchard, moderately eroded------------- | 75 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.15 | Slow water movement | 0.15 | Slow water movement | 0.15 |
| 59F2: | | | | | | | |
| Burchard, moderately eroded------------- | 80 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.15 | Slow water movement | 0.15 | Slow water movement | 0.15 |
| 93D2: | | | | | | | |
| Shelby, moderately eroded------------- | 65 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.15 | Slow water movement | 0.15 | Slow water movement | 0.15 |
| | | | | | | Gravel content | 0.08 |
| Adair, moderately eroded------------- | 20 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Slow water movement | 0.94 | Slow water movement | 0.94 | Slope | 1.00 |
| | | Slope | 0.63 | Slope | 0.63 | Slow water movement | 0.94 |
| 99D2: | | | | | | | |
| Exira, moderately eroded------------- | 50 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| 99E2: | | | | | | | |
| Exira, moderately eroded------------- | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 99F2: | | | | | | | |
| Exira, moderately eroded------------- | 50 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 100B: | | | | | | | |
| Monona-------------- | 55 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.50 |

Camp Areas, Picnic Areas, and Playgrounds--Continued

| Map symbol and soil name | Pct. of map unit | Camp areas | | Picnic areas | | Playgrounds | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 100C2: | | | | | | | |
| Monona, moderately eroded | 55 | Not limited | | Not limited | | Very limited | |
| | | | | | | Slope | 1.00 |
| 100D2: | | | | | | | |
| Monona, moderately eroded | 45 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| 100D3: | | | | | | | |
| Monona, severely eroded | 45 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| 100E2: | | | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 100F2: | | | | | | | |
| Monona, moderately eroded | 55 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 101F3: | | | | | | | |
| Monona, moderately eroded | 40 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| Ida, severely eroded | 30 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 212: | | | | | | | |
| Kennebec, occasionally flooded | 70 | Very limited | | Not limited | | Somewhat limited | |
| | | Flooding | 1.00 | | | Flooding | 0.60 |
| 220: | | | | | | | |
| Nodaway, occasionally flooded | 75 | Very limited | | Not limited | | Somewhat limited | |
| | | Flooding | 1.00 | | | Flooding | 0.60 |
| 222D2: | | | | | | | |
| Clarinda, moderately eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Slow water movement | 1.00 |
| | | Slow water movement | 1.00 | Slow water movement | 1.00 | Depth to saturated zone | 1.00 |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |

Camp Areas, Picnic Areas, and Playgrounds--Continued

| Map symbol and soil name | Pct. of map unit | Camp areas: Rating class and limiting features | Camp areas: Value | Picnic areas: Rating class and limiting features | Picnic areas: Value | Playgrounds: Rating class and limiting features | Playgrounds: Value |
|---|---|---|---|---|---|---|---|
| 430: | | | | | | | |
| Ackmore, occasionally flooded----------- | 75 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Flooding | 1.00 | | | Flooding | 0.60 |
| 431B: | | | | | | | |
| Judson------------- | 55 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.12 |
| Ackmore, rarely flooded----------- | 25 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Flooding | 1.00 | | | | |
| Colo, overwash, frequently flooded | 15 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Flooding | 1.00 | Flooding | 0.40 | Flooding | 1.00 |
| 509: | | | | | | | |
| Marshall, bench----- | 75 | Not limited | | Not limited | | Not limited | |
| 509B: | | | | | | | |
| Marshall, bench----- | 90 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.12 |
| 509C: | | | | | | | |
| Marshall, bench----- | 85 | Not limited | | Not limited | | Very limited | |
| | | | | | | Slope | 1.00 |
| 509D2: | | | | | | | |
| Marshall, bench, moderately eroded-- | 65 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| 630: | | | | | | | |
| Danbury, occasionally flooded----------- | 80 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Flooding | 1.00 | Depth to saturated zone | 0.19 | Flooding | 0.60 |
| | | Depth to saturated zone | 0.39 | | | Depth to saturated zone | 0.39 |
| 700B: | | | | | | | |
| Monona, bench------- | 75 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.12 |
| 700C2: | | | | | | | |
| Monona, bench, moderately eroded-- | 50 | Not limited | | Not limited | | Very limited | |
| | | | | | | Slope | 1.00 |

Camp Areas, Picnic Areas, and Playgrounds--Continued

| Map symbol and soil name | Pct. of map unit | Camp areas | | Picnic areas | | Playgrounds | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 700D2: | | | | | | | |
| Monona, bench, moderately eroded-- | 60 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| 5010: | | | | | | | |
| Pits, sand and gravel------------ | 100 | Not rated | | Not rated | | Not rated | |
| 5040: | | | | | | | |
| Udorthents, loamy--- | 100 | Not rated | | Not rated | | Not rated | |
| 5080: | | | | | | | |
| Udorthents, sanitary landfill---------- | 100 | Not rated | | Not rated | | Not rated | |
| AW: | | | | | | | |
| Animal waste lagoon | 100 | Not rated | | Not rated | | Not rated | |
| SL: | | | | | | | |
| Sewage lagoon------- | 100 | Not rated | | Not rated | | Not rated | |
| W: | | | | | | | |
| Water--------------- | 100 | Not rated | | Not rated | | Not rated | |

Paths, Trails, and Golf Fairways

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

| Map symbol and soil name | Pct. of map unit | Paths and trails | | Off-road motorcycle trails | | Golf fairways | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 1C3: | | | | | | | |
| Ida, severely eroded | 80 | Not limited | | Not limited | | Not limited | |
| 1D3: | | | | | | | |
| Ida, severely eroded | 80 | Very limited | | Very limited | | Somewhat limited | |
| | | Water erosion | 1.00 | Water erosion | 1.00 | Slope | 0.63 |
| 1E3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Water erosion | 1.00 | Water erosion | 1.00 | Slope | 1.00 |
| | | Slope | 0.08 | | | | |
| 1F3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Water erosion | 1.00 | Water erosion | 1.00 | Slope | 1.00 |
| | | Slope | 1.00 | | | | |
| 8B: | | | | | | | |
| Judson-------------- | 80 | Not limited | | Not limited | | Not limited | |
| 8C: | | | | | | | |
| Judson-------------- | 95 | Not limited | | Not limited | | Not limited | |
| 9: | | | | | | | |
| Marshall------------ | 95 | Not limited | | Not limited | | Not limited | |
| 9B: | | | | | | | |
| Marshall------------ | 100 | Not limited | | Not limited | | Not limited | |
| 9C2: | | | | | | | |
| Marshall, moderately eroded------------- | 80 | Not limited | | Not limited | | Not limited | |
| 9D2: | | | | | | | |
| Marshall, moderately eroded------------- | 70 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.63 |
| 10C2: | | | | | | | |
| Monona, moderately eroded------------- | 75 | Not limited | | Not limited | | Not limited | |
| 10D2: | | | | | | | |
| Monona, moderately eroded------------- | 60 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.63 |
| 10E2: | | | | | | | |
| Monona, moderately eroded------------- | 40 | Somewhat limited | | Not limited | | Very limited | |
| | | Slope | 0.08 | | | Slope | 1.00 |

Paths, Trails, and Golf Fairways--Continued

| Map symbol and soil name | Pct. of map unit | Paths and trails: Rating class and limiting features | Value | Off-road motorcycle trails: Rating class and limiting features | Value | Golf fairways: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 10F2: | | | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Not limited | | Very limited | |
| | | Slope | 1.00 | | | Slope | 1.00 |
| 12B: | | | | | | | |
| Napier | 90 | Not limited | | Not limited | | Not limited | |
| 12C: | | | | | | | |
| Napier | 95 | Not limited | | Not limited | | Not limited | |
| 24E2: | | | | | | | |
| Shelby, moderately eroded | 70 | Somewhat limited | | Not limited | | Very limited | |
| | | Slope | 0.02 | | | Slope | 1.00 |
| 24F2: | | | | | | | |
| Shelby, moderately eroded | 50 | Somewhat limited | | Not limited | | Very limited | |
| | | Slope | 0.82 | | | Slope | 1.00 |
| 35D2: | | | | | | | |
| Liston, moderately eroded | 55 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.63 |
| Burchard, moderately eroded | 35 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.63 |
| 54: | | | | | | | |
| Zook, occasionally flooded | 90 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | | | | | Flooding | 0.60 |
| 54+: | | | | | | | |
| Zook, overwash, occasionally flooded | 85 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | | | | | Flooding | 0.60 |
| 59E2: | | | | | | | |
| Burchard, moderately eroded | 75 | Somewhat limited | | Not limited | | Very limited | |
| | | Slope | 0.02 | | | Slope | 1.00 |
| 59F2: | | | | | | | |
| Burchard, moderately eroded | 80 | Somewhat limited | | Not limited | | Very limited | |
| | | Slope | 0.68 | | | Slope | 1.00 |

Paths, Trails, and Golf Fairways--Continued

| Map symbol and soil name | Pct. of map unit | Paths and trails: Rating class and limiting features | Value | Off-road motorcycle trails: Rating class and limiting features | Value | Golf fairways: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 93D2: | | | | | | | |
| Shelby, moderately eroded | 65 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.63 |
| Adair, moderately eroded | 20 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | | | | | Slope | 0.63 |
| 99D2: | | | | | | | |
| Exira, moderately eroded | 50 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.63 |
| 99E2: | | | | | | | |
| Exira, moderately eroded | 45 | Somewhat limited | | Not limited | | Very limited | |
| | | Slope | 0.02 | | | Slope | 1.00 |
| 99F2: | | | | | | | |
| Exira, moderately eroded | 50 | Somewhat limited | | Not limited | | Very limited | |
| | | Slope | 0.82 | | | Slope | 1.00 |
| 100B: | | | | | | | |
| Monona | 55 | Not limited | | Not limited | | Not limited | |
| 100C2: | | | | | | | |
| Monona, moderately eroded | 55 | Not limited | | Not limited | | Not limited | |
| 100D2: | | | | | | | |
| Monona, moderately eroded | 45 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.63 |
| 100D3: | | | | | | | |
| Monona, severely eroded | 45 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.63 |
| 100E2: | | | | | | | |
| Monona, moderately eroded | 45 | Somewhat limited | | Not limited | | Very limited | |
| | | Slope | 0.08 | | | Slope | 1.00 |
| 100F2: | | | | | | | |
| Monona, moderately eroded | 55 | Very limited | | Not limited | | Very limited | |
| | | Slope | 1.00 | | | Slope | 1.00 |

Paths, Trails, and Golf Fairways--Continued

| Map symbol and soil name | Pct. of map unit | Paths and trails: Rating class and limiting features | Value | Off-road motorcycle trails: Rating class and limiting features | Value | Golf fairways: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 101F3: | | | | | | | |
| Monona, moderately eroded------------- | 40 | Very limited | | Not limited | | Very limited | |
| | | Slope | 1.00 | | | Slope | 1.00 |
| Ida, severely eroded | 30 | Very limited | | Very limited | | Very limited | |
| | | Water erosion | 1.00 | Water erosion | 1.00 | Slope | 1.00 |
| | | Slope | 1.00 | | | | |
| 212: | | | | | | | |
| Kennebec, occasionally flooded----------- | 70 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Flooding | 0.60 |
| 220: | | | | | | | |
| Nodaway, occasionally flooded----------- | 75 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Flooding | 0.60 |
| 222D2: | | | | | | | |
| Clarinda, moderately eroded------------- | 70 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Water erosion | 1.00 | Water erosion | 1.00 | Slope | 0.63 |
| 430: | | | | | | | |
| Ackmore, occasionally flooded----------- | 75 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | | | | | Flooding | 0.60 |
| 431B: | | | | | | | |
| Judson-------------- | 55 | Not limited | | Not limited | | Not limited | |
| Ackmore, rarely flooded----------- | 25 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| Colo, overwash, frequently flooded | 15 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Flooding | 1.00 |
| | | Flooding | 0.40 | Flooding | 0.40 | Depth to saturated zone | 1.00 |
| 509: | | | | | | | |
| Marshall, bench----- | 75 | Not limited | | Not limited | | Not limited | |
| 509B: | | | | | | | |
| Marshall, bench----- | 90 | Not limited | | Not limited | | Not limited | |
| 509C: | | | | | | | |
| Marshall, bench----- | 85 | Not limited | | Not limited | | Not limited | |

Paths, Trails, and Golf Fairways--Continued

| Map symbol and soil name | Pct. of map unit | Paths and trails: Rating class and limiting features | Value | Off-road motorcycle trails: Rating class and limiting features | Value | Golf fairways: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 509D2: | | | | | | | |
| Marshall, bench, moderately eroded-- | 65 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.63 |
| 630: | | | | | | | |
| Danbury, occasionally flooded----------- | 80 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Flooding | 0.60 |
| | | | | | | Depth to saturated zone | 0.19 |
| 700B: | | | | | | | |
| Monona, bench------- | 75 | Not limited | | Not limited | | Not limited | |
| 700C2: | | | | | | | |
| Monona, bench, moderately eroded-- | 50 | Not limited | | Not limited | | Not limited | |
| 700D2: | | | | | | | |
| Monona, bench, moderately eroded-- | 60 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.63 |
| 5010: | | | | | | | |
| Pits, sand and gravel------------- | 100 | Not rated | | Not rated | | Not rated | |
| 5040: | | | | | | | |
| Udorthents, loamy--- | 100 | Not rated | | Not rated | | Not rated | |
| 5080: | | | | | | | |
| Udorthents, sanitary landfill----------- | 100 | Not rated | | Not rated | | Not rated | |
| AW: | | | | | | | |
| Animal waste lagoon | 100 | Not rated | | Not rated | | Not rated | |
| SL: | | | | | | | |
| Sewage lagoon------- | 100 | Not rated | | Not rated | | Not rated | |
| W: | | | | | | | |
| Water--------------- | 100 | Not rated | | Not rated | | Not rated | |

# Engineering

This section provides information for planning land uses related to urban development and to water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. The ratings are based on observed performance of the soils and on the data in the tables described under the heading “Soil Properties.”

*Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil between the surface and a depth of 5 to 7 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.*

*The information is not site specific and does not eliminate the need for onsite investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.*

*Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, in site selection, and in design.*

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about particle-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 to 7 feet of the surface, soil wetness, depth to a water table, ponding, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kinds of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to evaluate the potential of areas for residential, commercial, industrial, and recreational uses; make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; evaluate alternative sites for sanitary landfills, septic tank absorption fields, and sewage lagoons; plan detailed onsite investigations of soils and geology; locate potential sources of gravel, sand, reclamation material, roadfill, and topsoil; plan structures for water management; and predict performance of proposed small structures and pavements by comparing the performance of existing similar structures on the same or similar soils.

The information in the tables, along with the soil maps, the soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the Glossary, which is in Part I of this publication.

## Building Site Development

The titles of the tables described in this section are:

- "Dwellings and Small Commercial Buildings"
- "Roads and Streets, Shallow Excavations, and Lawns and Landscaping"

Soil properties influence the development of building sites, including the selection of the site, the design of the structure, construction, performance after construction, and maintenance. The tables described in this section show the degree and kind of soil limitations that affect dwellings with and without basements, small commercial buildings, local roads and streets, shallow excavations, and lawns and landscaping.

The ratings in the tables are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect building site development. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

*Dwellings* are single-family houses of three stories or less. For dwellings without basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. For dwellings with basements, the foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of about 7 feet. The ratings for dwellings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility. Compressibility is inferred from the Unified classification. The properties that affect the ease and amount of excavation include depth to a water table, ponding, flooding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

*Small commercial buildings* are structures that are less than three stories high and do not have basements. The foundation is assumed to consist of spread footings of reinforced concrete built on undisturbed soil at a depth of 2 feet or at the depth of maximum frost penetration, whichever is deeper. The ratings are based on the soil properties that affect the capacity of the soil to support a load without movement and on the properties that affect excavation and construction costs. The properties that affect the load-supporting capacity include depth to a water table, ponding, flooding, subsidence, linear extensibility (shrink-swell potential), and compressibility (which is inferred from the Unified classification). The properties that affect the ease and amount of excavation include flooding, depth to a water table, ponding, slope, depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, and the amount and size of rock fragments.

*Local roads and streets* have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or soil material stabilized by lime or cement; and a surface of flexible material (asphalt), rigid material (concrete), or gravel with a binder. The ratings are based on the soil properties that affect the ease of excavation and grading and the traffic-supporting capacity. The properties that affect the ease of excavation and grading are depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, depth to a water table, ponding, flooding, the amount of large stones, and slope. The properties that affect the traffic-supporting capacity are soil strength (as inferred from the AASHTO group index number), subsidence, linear extensibility (shrink-swell potential), the potential for frost action, depth to a water table, and ponding.

*Shallow excavations* are trenches or holes dug to a maximum depth of 5 or 6 feet for graves, utility lines, open ditches, or other purposes. The ratings are based on the soil properties that influence the ease of digging and the resistance to sloughing. Depth to bedrock or a cemented pan, hardness of bedrock or a cemented pan, the amount of large stones, and dense layers influence the ease of digging, filling, and compacting. Depth to the seasonal high water table, flooding, and ponding may restrict the period when excavations can be made. Slope influences the ease of using machinery. Soil texture, depth to the water table, and linear extensibility (shrink-swell potential) influence the resistance to sloughing.

*Lawns and landscaping* require soils on which turf and ornamental trees and shrubs can be established and maintained. Irrigation is not considered in the ratings. The ratings are based on the soil properties that affect plant growth and trafficability after vegetation is established. The properties that affect plant growth are reaction; depth to a water table; ponding; depth to bedrock or a cemented pan; the available water capacity in the upper 40 inches; the content of salts, sodium, or calcium carbonate; and sulfidic materials. The properties that affect trafficability are flooding, depth to a water table, ponding, slope, stoniness, and the amount of sand, clay, or organic matter in the surface layer.

Dwellings and Small Commercial Buildings

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

| Map symbol and soil name | Pct. of map unit | Dwellings without basements | | Dwellings with basements | | Small commercial buildings | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 1C3: | | | | | | | |
| Ida, severely eroded | 80 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.88 |
| 1D3: | | | | | | | |
| Ida, severely eroded | 80 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| 1E3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 1F3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 8B: | | | | | | | |
| Judson-------------- | 80 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 8C: | | | | | | | |
| Judson-------------- | 95 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Slope | 0.88 |
| | | | | | | Shrink-swell | 0.50 |
| 9: | | | | | | | |
| Marshall------------ | 95 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 9B: | | | | | | | |
| Marshall------------ | 100 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 9C2: | | | | | | | |
| Marshall, moderately eroded------------ | 80 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Slope | 0.88 |
| | | | | | | Shrink-swell | 0.50 |
| 9D2: | | | | | | | |
| Marshall, moderately eroded------------ | 70 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 10C2: | | | | | | | |
| Monona, moderately eroded------------ | 75 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | | | Slope | 0.88 |
| | | | | | | Shrink-swell | 0.50 |

Dwellings and Small Commercial Buildings--Continued

| Map symbol and soil name | Pct. of map unit | Dwellings without basements: Rating class and limiting features | Value | Dwellings with basements: Rating class and limiting features | Value | Small commercial buildings: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 10D2: | | | | | | | |
| Monona, moderately eroded------------ | 60 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |
| 10E2: | | | | | | | |
| Monona, moderately eroded------------ | 40 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |
| 10F2: | | | | | | | |
| Monona, moderately eroded------------ | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |
| 12B: | | | | | | | |
| Napier-------------- | 90 | Not limited | | Not limited | | Not limited | |
| 12C: | | | | | | | |
| Napier-------------- | 95 | Not limited | | Not limited | | Somewhat limited | |
| | | | | | | Slope | 0.88 |
| 24E2: | | | | | | | |
| Shelby, moderately eroded------------ | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 24F2: | | | | | | | |
| Shelby, moderately eroded------------ | 50 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 35D2: | | | | | | | |
| Liston, moderately eroded------------ | 55 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| Burchard, moderately eroded------------ | 35 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 54: | | | | | | | |
| Zook, occasionally flooded----------- | 90 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Flooding | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Shrink-swell | 1.00 | Shrink-swell | 1.00 | Shrink-swell | 1.00 |

Dwellings and Small Commercial Buildings--Continued

| Map symbol and soil name | Pct. of map unit | Dwellings without basements | | Dwellings with basements | | Small commercial buildings | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 54+: | | | | | | | |
| Zook, overwash, occasionally flooded | 85 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Flooding | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Shrink-swell | 1.00 | Shrink-swell | 1.00 | Shrink-swell | 1.00 |
| 59E2: | | | | | | | |
| Burchard, moderately eroded | 75 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 59F2: | | | | | | | |
| Burchard, moderately eroded | 80 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 93D2: | | | | | | | |
| Shelby, moderately eroded | 65 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| Adair, moderately eroded | 20 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 1.00 | Shrink-swell | 1.00 | Depth to saturated zone | 1.00 |
| | | Slope | 0.63 | Slope | 0.63 | Shrink-swell | 1.00 |
| 99D2: | | | | | | | |
| Exira, moderately eroded | 50 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 99E2: | | | | | | | |
| Exira, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 99F2: | | | | | | | |
| Exira, moderately eroded | 50 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 100B: | | | | | | | |
| Monona | 55 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |

Dwellings and Small Commercial Buildings--Continued

| Map symbol and soil name | Pct. of map unit | Dwellings without basements: Rating class and limiting features | Value | Dwellings with basements: Rating class and limiting features | Value | Small commercial buildings: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 100C2: | | | | | | | |
| Monona, moderately eroded | 55 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | | | Slope | 0.88 |
| | | | | | | Shrink-swell | 0.50 |
| 100D2: | | | | | | | |
| Monona, moderately eroded | 45 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |
| 100D3: | | | | | | | |
| Monona, severely eroded | 45 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |
| 100E2: | | | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |
| 100F2: | | | | | | | |
| Monona, moderately eroded | 55 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |
| 101F3: | | | | | | | |
| Monona, moderately eroded | 40 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |
| Ida, severely eroded | 30 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 212: | | | | | | | |
| Kennebec, occasionally flooded | 70 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Flooding | 1.00 |
| | | Shrink-swell | 0.50 | Depth to saturated zone | 0.61 | Shrink-swell | 0.50 |
| | | | | Shrink-swell | 0.50 | | |
| 220: | | | | | | | |
| Nodaway, occasionally flooded | 75 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Flooding | 1.00 |
| | | Shrink-swell | 0.50 | Depth to saturated zone | 0.64 | Shrink-swell | 0.50 |
| | | | | Shrink-swell | 0.50 | | |

Dwellings and Small Commercial Buildings--Continued

| Map symbol and soil name | Pct. of map unit | Dwellings without basements: Rating class and limiting features | Value | Dwellings with basements: Rating class and limiting features | Value | Small commercial buildings: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 222D2: | | | | | | | |
| Clarinda, moderately eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Slope | 1.00 |
| | | Shrink-swell | 1.00 | Shrink-swell | 1.00 | Depth to saturated zone | 1.00 |
| | | Slope | 0.63 | Slope | 0.63 | Shrink-swell | 1.00 |
| 430: | | | | | | | |
| Ackmore, occasionally flooded | 75 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Flooding | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 1.00 | Shrink-swell | 0.50 |
| 431B: | | | | | | | |
| Judson | 55 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| Ackmore, rarely flooded | 25 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Flooding | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 1.00 | Shrink-swell | 0.50 |
| Colo, overwash, frequently flooded | 15 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Flooding | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 509: | | | | | | | |
| Marshall, bench | 75 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 509B: | | | | | | | |
| Marshall, bench | 90 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |
| 509C: | | | | | | | |
| Marshall, bench | 85 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Slope | 0.88 |
| | | | | | | Shrink-swell | 0.50 |
| 509D2: | | | | | | | |
| Marshall, bench, moderately eroded | 65 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | Shrink-swell | 0.50 | Shrink-swell | 0.50 |

Dwellings and Small Commercial Buildings--Continued

| Map symbol and soil name | Pct. of map unit | Dwellings without basements: Rating class and limiting features | Value | Dwellings with basements: Rating class and limiting features | Value | Small commercial buildings: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 630: | | | | | | | |
| Danbury, occasionally flooded | 80 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Flooding | 1.00 |
| | | Shrink-swell | 0.50 | Depth to saturated zone | 1.00 | Shrink-swell | 0.50 |
| | | Depth to saturated zone | 0.39 | Shrink-swell | 1.00 | Depth to saturated zone | 0.39 |
| 700B: | | | | | | | |
| Monona, bench | 75 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |
| 700C2: | | | | | | | |
| Monona, bench, moderately eroded | 50 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Shrink-swell | 0.50 | | | Slope | 0.88 |
| | | | | | | Shrink-swell | 0.50 |
| 700D2: | | | | | | | |
| Monona, bench, moderately eroded | 60 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 1.00 |
| | | Shrink-swell | 0.50 | | | Shrink-swell | 0.50 |
| 5010: | | | | | | | |
| Pits, sand and gravel | 100 | Not rated | | Not rated | | Not rated | |
| 5040: | | | | | | | |
| Udorthents, loamy | 100 | Not rated | | Not rated | | Not rated | |
| 5080: | | | | | | | |
| Udorthents, sanitary landfill | 100 | Not rated | | Not rated | | Not rated | |
| AW: | | | | | | | |
| Animal waste lagoon | 100 | Not rated | | Not rated | | Not rated | |
| SL: | | | | | | | |
| Sewage lagoon | 100 | Not rated | | Not rated | | Not rated | |
| W: | | | | | | | |
| Water | 100 | Not rated | | Not rated | | Not rated | |

Roads and Streets, Shallow Excavations, and Lawns and Landscaping

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

| Map symbol and soil name | Pct. of map unit | Local roads and streets | | Shallow excavations | | Lawns and landscaping | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 1C3: | | | | | | | |
| Ida, severely eroded | 80 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| 1D3: | | | | | | | |
| Ida, severely eroded | 80 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Frost action | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Slope | 0.63 | Cutbanks cave | 0.10 | | |
| 1E3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Frost action | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Slope | 1.00 | Cutbanks cave | 0.10 | | |
| 1F3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| 8B: | | | | | | | |
| Judson | 80 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 8C: | | | | | | | |
| Judson | 95 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 9: | | | | | | | |
| Marshall | 95 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 9B: | | | | | | | |
| Marshall | 100 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 9C2: | | | | | | | |
| Marshall, moderately eroded | 80 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 9D2: | | | | | | | |
| Marshall, moderately eroded | 70 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Frost action | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Slope | 0.63 | | | | |

Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

| Map symbol and soil name | Pct. of map unit | Local roads and streets: Rating class and limiting features | Value | Shallow excavations: Rating class and limiting features | Value | Lawns and landscaping: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 10C2: | | | | | | | |
| Monona, moderately eroded | 75 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Low strength | 1.00 | | | | |
| | | Shrink-swell | 0.50 | | | | |
| 10D2: | | | | | | | |
| Monona, moderately eroded | 60 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Frost action | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Slope | 0.63 | | | | |
| 10E2: | | | | | | | |
| Monona, moderately eroded | 40 | Very limited | | Very limited | | Very limited | |
| | | Frost action | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Slope | 1.00 | | | | |
| 10F2: | | | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Low strength | 1.00 | | | | |
| 12B: | | | | | | | |
| Napier | 90 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| 12C: | | | | | | | |
| Napier | 95 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| 24E2: | | | | | | | |
| Shelby, moderately eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 24F2: | | | | | | | |
| Shelby, moderately eroded | 50 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 35D2: | | | | | | | |
| Liston, moderately eroded | 55 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Low strength | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Slope | 0.63 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |

Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

| Map symbol and soil name | Pct. of map unit | Local roads and streets: Rating class and limiting features | Value | Shallow excavations: Rating class and limiting features | Value | Lawns and landscaping: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 35D2: | | | | | | | |
| Burchard, moderately eroded | 35 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Low strength | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Slope | 0.63 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 54: | | | | | | | |
| Zook, occasionally flooded | 90 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Frost action | 1.00 | Flooding | 0.60 | Flooding | 0.60 |
| | | Flooding | 1.00 | Cutbanks cave | 0.10 | | |
| 54+: | | | | | | | |
| Zook, overwash, occasionally flooded | 85 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Frost action | 1.00 | Flooding | 0.60 | Flooding | 0.60 |
| | | Flooding | 1.00 | Cutbanks cave | 0.10 | | |
| 59E2: | | | | | | | |
| Burchard, moderately eroded | 75 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 59F2: | | | | | | | |
| Burchard, moderately eroded | 80 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 93D2: | | | | | | | |
| Shelby, moderately eroded | 65 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Low strength | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Slope | 0.63 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| Adair, moderately eroded | 20 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Frost action | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| 99D2: | | | | | | | |
| Exira, moderately eroded | 50 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Frost action | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Slope | 0.63 | | | | |

Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

| Map symbol and soil name | Pct. of map unit | Local roads and streets: Rating class and limiting features | Value | Shallow excavations: Rating class and limiting features | Value | Lawns and landscaping: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 99E2: | | | | | | | |
| Exira, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Frost action | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Slope | 1.00 | | | | |
| 99F2: | | | | | | | |
| Exira, moderately eroded | 50 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Low strength | 1.00 | | | | |
| 100B: | | | | | | | |
| Monona | 55 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Low strength | 1.00 | | | | |
| | | Shrink-swell | 0.50 | | | | |
| 100C2: | | | | | | | |
| Monona, moderately eroded | 55 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Low strength | 1.00 | | | | |
| | | Shrink-swell | 0.50 | | | | |
| 100D2: | | | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Frost action | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Slope | 0.63 | | | | |
| 100D3: | | | | | | | |
| Monona, severely eroded | 45 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Frost action | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Slope | 0.63 | | | | |
| 100E2: | | | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Frost action | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Slope | 1.00 | | | | |
| 100F2: | | | | | | | |
| Monona, moderately eroded | 55 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Low strength | 1.00 | | | | |

Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

| Map symbol and soil name | Pct. of map unit | Local roads and streets: Rating class and limiting features | Value | Shallow excavations: Rating class and limiting features | Value | Lawns and landscaping: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 101F3: | | | | | | | |
| Monona, moderately eroded | 40 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Low strength | 1.00 | | | | |
| Ida, severely eroded | 30 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| 212: | | | | | | | |
| Kennebec, occasionally flooded | 70 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Frost action | 1.00 | Depth to saturated zone | 0.61 | Flooding | 0.60 |
| | | Flooding | 1.00 | Flooding | 0.60 | | |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| 220: | | | | | | | |
| Nodaway, occasionally flooded | 75 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Frost action | 1.00 | Depth to saturated zone | 0.64 | Flooding | 0.60 |
| | | Flooding | 1.00 | Flooding | 0.60 | | |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| 222D2: | | | | | | | |
| Clarinda, moderately eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Frost action | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Low strength | 1.00 | Too clayey | 0.50 | | |
| 430: | | | | | | | |
| Ackmore, occasionally flooded | 75 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Frost action | 1.00 | Flooding | 0.60 | Flooding | 0.60 |
| | | Flooding | 1.00 | Cutbanks cave | 0.10 | | |
| 431B: | | | | | | | |
| Judson | 55 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| Ackmore, rarely flooded | 25 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Low strength | 1.00 | | | | |

Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

| Map symbol and soil name | Pct. of map unit | Local roads and streets: Rating class and limiting features | Value | Shallow excavations: Rating class and limiting features | Value | Lawns and landscaping: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 431B: | | | | | | | |
| Colo, overwash, frequently flooded | 15 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Flooding | 1.00 |
| | | Frost action | 1.00 | Flooding | 0.80 | Depth to saturated zone | 1.00 |
| | | Flooding | 1.00 | Cutbanks cave | 0.10 | | |
| 509: | | | | | | | |
| Marshall, bench----- | 75 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 509B: | | | | | | | |
| Marshall, bench----- | 90 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 509C: | | | | | | | |
| Marshall, bench----- | 85 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Shrink-swell | 0.50 | | | | |
| 509D2: | | | | | | | |
| Marshall, bench, moderately eroded-- | 65 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Frost action | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Slope | 0.63 | | | | |
| 630: | | | | | | | |
| Danbury, occasionally flooded------------ | 80 | Very limited | | Very limited | | Somewhat limited | |
| | | Frost action | 1.00 | Depth to saturated zone | 1.00 | Flooding | 0.60 |
| | | Flooding | 1.00 | Flooding | 0.60 | Depth to saturated zone | 0.19 |
| | | Shrink-swell | 0.50 | Cutbanks cave | 0.10 | | |
| 700B: | | | | | | | |
| Monona, bench------- | 75 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Low strength | 1.00 | | | | |
| | | Shrink-swell | 0.50 | | | | |
| 700C2: | | | | | | | |
| Monona, bench, moderately eroded-- | 50 | Very limited | | Somewhat limited | | Not limited | |
| | | Frost action | 1.00 | Cutbanks cave | 0.10 | | |
| | | Low strength | 1.00 | | | | |
| | | Shrink-swell | 0.50 | | | | |
| 700D2: | | | | | | | |
| Monona, bench, moderately eroded-- | 60 | Very limited | | Somewhat limited | | Somewhat limited | |
| | | Frost action | 1.00 | Slope | 0.63 | Slope | 0.63 |
| | | Low strength | 1.00 | Cutbanks cave | 0.10 | | |
| | | Slope | 0.63 | | | | |

Roads and Streets, Shallow Excavations, and Lawns and Landscaping--Continued

| Map symbol and soil name | Pct. of map unit | Local roads and streets | | Shallow excavations | | Lawns and landscaping | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 5010: | | | | | | | |
| Pits, sand and gravel | 100 | Not rated | | Not rated | | Not rated | |
| 5040: | | | | | | | |
| Udorthents, loamy | 100 | Not rated | | Not rated | | Not rated | |
| 5080: | | | | | | | |
| Udorthents, sanitary landfill | 100 | Not rated | | Not rated | | Not rated | |
| AW: | | | | | | | |
| Animal waste lagoon | 100 | Not rated | | Not rated | | Not rated | |
| SL: | | | | | | | |
| Sewage lagoon | 100 | Not rated | | Not rated | | Not rated | |
| W: | | | | | | | |
| Water | 100 | Not rated | | Not rated | | Not rated | |

## Sanitary Facilities

The titles of the tables described in this section are:

- “Sewage Disposal”
- “Landfills”

These tables show the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, sanitary landfills, and daily cover for landfill. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the tables indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

*Septic tank absorption fields* are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 60 inches is evaluated. The ratings are based on the soil properties that affect absorption of the effluent, construction and maintenance of the system, and public health. Permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, and flooding affect absorption of the effluent. Stones and boulders, ice, and bedrock or a cemented pan interfere with installation. Subsidence interferes with installation and maintenance. Excessive slope may cause lateral seepage and surfacing of the effluent in downslope areas.

Some soils are underlain by loose sand and gravel or fractured bedrock at a depth of less than 4 feet below the distribution lines. In these soils the absorption field may not adequately filter the effluent, particularly when the system is new. As a result, the ground water may become contaminated.

*Sewage lagoons* are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments of compacted soil. Nearly impervious soil material for the lagoon floor and sides is required to minimize seepage and contamination of ground water. Considered in the ratings are slope, permeability, depth to a water table, ponding, depth to bedrock or a cemented pan, flooding, large stones, and content of organic matter.

Soil permeability is a critical property affecting the suitability for sewage lagoons. Most porous soils eventually become sealed when they are used as sites for sewage lagoons. Until sealing occurs, however, the hazard of pollution is severe. Soils that have a permeability rate of more than 2 inches per hour are too porous for the proper functioning of sewage lagoons. In these soils, seepage of the effluent can result in contamination of the ground water. Ground-water contamination is also a hazard if fractured bedrock is within a depth of 40 inches, if the water table is high enough to raise the level of sewage in the lagoon, or if floodwater overtops the lagoon.

A high content of organic matter is detrimental to proper functioning of the lagoon because it inhibits aerobic activity. Slope, bedrock, and cemented pans can cause construction problems, and large stones can hinder compaction of the lagoon floor. If

the lagoon is to be uniformly deep throughout, the slope must be gentle enough and the soil material must be thick enough over bedrock or a cemented pan to make land smoothing practical.

A *trench sanitary landfill* is an area where solid waste is placed in successive layers in an excavated trench. The waste is spread, compacted, and covered daily with a thin layer of soil excavated at the site. When the trench is full, a final cover of soil material at least 2 feet thick is placed over the landfill. The ratings in the table are based on the soil properties that affect the risk of pollution, the ease of excavation, trafficability, and revegetation. These properties include permeability, depth to bedrock or a cemented pan, depth to a water table, ponding, slope, flooding, texture, stones and boulders, highly organic layers, soil reaction, and content of salts and sodium. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, onsite investigation may be needed.

Hard, nonrippable bedrock, creviced bedrock, or highly permeable strata in or directly below the proposed trench bottom can affect the ease of excavation and the hazard of ground-water pollution. Slope affects construction of the trenches and the movement of surface water around the landfill. It also affects the construction and performance of roads in areas of the landfill.

Soil texture and consistence affect the ease with which the trench is dug and the ease with which the soil can be used as daily or final cover. They determine the workability of the soil when dry and when wet. Soils that are plastic and sticky when wet are difficult to excavate, grade, or compact and are difficult to place as a uniformly thick cover over a layer of refuse.

The soil material used as the final cover for a trench landfill should be suitable for plants. It should not have excess sodium or salts and should not be too acid. The surface layer generally has the best workability, the highest content of organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

In an *area sanitary landfill*, solid waste is placed in successive layers on the surface of the soil. The waste is spread, compacted, and covered daily with a thin layer of soil from a source away from the site. A final cover of soil material at least 2 feet thick is placed over the completed landfill. The ratings in the table are based on the soil properties that affect trafficability and the risk of pollution. These properties include flooding, permeability, depth to a water table, ponding, slope, and depth to bedrock or a cemented pan.

Flooding is a serious problem because it can result in pollution in areas downstream from the landfill. If permeability is too rapid or if fractured bedrock, a fractured cemented pan, or the water table is close to the surface, the leachate can contaminate the water supply. Slope is a consideration because of the extra grading required to maintain roads in the steeper areas of the landfill. Also, leachate may flow along the surface of the soils in the steeper areas and cause difficult seepage problems.

*Daily cover for landfill* is the soil material that is used to cover compacted solid waste in an area sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste. The ratings in the table also apply to the final cover for a landfill. They are based on the soil properties that affect workability, the ease of digging, and the ease of moving and spreading the material over the refuse daily during wet and dry periods. These properties include soil texture, depth to a water table, ponding, rock fragments, slope, depth to bedrock or a cemented pan, reaction, and content of salts, sodium, or lime.

Loamy or silty soils that are free of large stones and excess gravel are the best cover for a landfill. Clayey soils may be sticky and difficult to spread; sandy soils are subject to wind erosion.

Slope affects the ease of excavation and of moving the cover material. Also, it can influence runoff, erosion, and reclamation of the borrow area.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, a cemented pan, or the water table to permit revegetation. The soil material used as the final cover for a landfill should be suitable for plants. It should not have excess sodium, salts, or lime and should not be too acid.

Sewage Disposal

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

| Map symbol and soil name | Pct. of map unit | Septic tank absorption fields | | Sewage lagoons | |
|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 1C3: | | | | | |
| Ida, severely eroded | 80 | Somewhat limited | | Very limited | |
| | | Slow water movement | 0.50 | Slope | 1.00 |
| | | | | Seepage | 0.50 |
| 1D3: | | | | | |
| Ida, severely eroded | 80 | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 1E3: | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 1F3: | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 8B: | | | | | |
| Judson-------------- | 80 | Somewhat limited | | Somewhat limited | |
| | | Slow water movement | 0.46 | Seepage | 0.53 |
| | | | | Slope | 0.32 |
| 8C: | | | | | |
| Judson-------------- | 95 | Somewhat limited | | Very limited | |
| | | Slow water movement | 0.46 | Slope | 1.00 |
| | | | | Seepage | 0.53 |
| 9: | | | | | |
| Marshall------------ | 95 | Somewhat limited | | Somewhat limited | |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 9B: | | | | | |
| Marshall------------ | 100 | Somewhat limited | | Somewhat limited | |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| | | | | Slope | 0.32 |
| 9C2: | | | | | |
| Marshall, moderately eroded------------- | 80 | Somewhat limited | | Very limited | |
| | | Slow water movement | 0.50 | Slope | 1.00 |
| | | | | Seepage | 0.50 |

Sewage Disposal--Continued

| Map symbol and soil name | Pct. of map unit | Septic tank absorption fields: Rating class and limiting features | Value | Sewage lagoons: Rating class and limiting features | Value |
|---|---|---|---|---|---|
| 9D2: | | | | | |
| Marshall, moderately eroded | 70 | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 10C2: | | | | | |
| Monona, moderately eroded | 75 | Somewhat limited | | Very limited | |
| | | Slow water movement | 0.50 | Slope | 1.00 |
| | | | | Seepage | 0.50 |
| 10D2: | | | | | |
| Monona, moderately eroded | 60 | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 10E2: | | | | | |
| Monona, moderately eroded | 40 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 10F2: | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 12B: | | | | | |
| Napier | 90 | Somewhat limited | | Somewhat limited | |
| | | Slow water movement | 0.46 | Seepage | 0.53 |
| | | | | Slope | 0.32 |
| 12C: | | | | | |
| Napier | 95 | Somewhat limited | | Very limited | |
| | | Slow water movement | 0.46 | Slope | 1.00 |
| | | | | Seepage | 0.53 |
| 24E2: | | | | | |
| Shelby, moderately eroded | 70 | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Slope | 1.00 |
| | | Slope | 1.00 | | |
| 24F2: | | | | | |
| Shelby, moderately eroded | 50 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 1.00 | | |

Sewage Disposal--Continued

| Map symbol and soil name | Pct. of map unit | Septic tank absorption fields | | Sewage lagoons | |
|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 35D2: | | | | | |
| Liston, moderately eroded------------- | 55 | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Slope | 1.00 |
| | | Slope | 0.63 | | |
| Burchard, moderately eroded------------- | 35 | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Slope | 1.00 |
| | | Slope | 0.63 | | |
| 54: | | | | | |
| Zook, occasionally flooded------------ | 90 | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 |
| | | Slow water movement | 1.00 | Depth to saturated zone | 1.00 |
| | | Depth to saturated zone | 1.00 | | |
| 54+: | | | | | |
| Zook, overwash, occasionally flooded------------ | 85 | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 |
| | | Slow water movement | 1.00 | Depth to saturated zone | 1.00 |
| | | Depth to saturated zone | 1.00 | | |
| 59E2: | | | | | |
| Burchard, moderately eroded------------- | 75 | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Slope | 1.00 |
| | | Slope | 1.00 | | |
| 59F2: | | | | | |
| Burchard, moderately eroded------------- | 80 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 1.00 | | |
| 93D2: | | | | | |
| Shelby, moderately eroded------------- | 65 | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Slope | 1.00 |
| | | Slope | 0.63 | | |
| Adair, moderately eroded------------- | 20 | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Slope | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Slope | 0.63 | | |

Sewage Disposal--Continued

| Map symbol and soil name | Pct. of map unit | Septic tank absorption fields | | Sewage lagoons | |
|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 99D2: | | | | | |
| Exira, moderately eroded | 50 | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 99E2: | | | | | |
| Exira, moderately eroded | 45 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 99F2: | | | | | |
| Exira, moderately eroded | 50 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 100B: | | | | | |
| Monona | 55 | Somewhat limited | | Somewhat limited | |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| | | | | Slope | 0.32 |
| 100C2: | | | | | |
| Monona, moderately eroded | 55 | Somewhat limited | | Very limited | |
| | | Slow water movement | 0.50 | Slope | 1.00 |
| | | | | Seepage | 0.50 |
| 100D2: | | | | | |
| Monona, moderately eroded | 45 | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 100D3: | | | | | |
| Monona, severely eroded | 45 | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 100E2: | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 100F2: | | | | | |
| Monona, moderately eroded | 55 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |

Sewage Disposal--Continued

| Map symbol and soil name | Pct. of map unit | Septic tank absorption fields: Rating class and limiting features | Value | Sewage lagoons: Rating class and limiting features | Value |
|---|---|---|---|---|---|
| 101F3: | | | | | |
| Monona, moderately eroded | 40 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| Ida, severely eroded | 30 | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 212: | | | | | |
| Kennebec, occasionally flooded | 70 | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 |
| | | Depth to saturated zone | 0.99 | Depth to saturated zone | 0.71 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 220: | | | | | |
| Nodaway, occasionally flooded | 75 | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 |
| | | Depth to saturated zone | 0.99 | Depth to saturated zone | 0.78 |
| | | Slow water movement | 0.98 | Seepage | 0.02 |
| 222D2: | | | | | |
| Clarinda, moderately eroded | 70 | Very limited | | Very limited | |
| | | Slow water movement | 1.00 | Slope | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Slope | 0.63 | | |
| 430: | | | | | |
| Ackmore, occasionally flooded | 75 | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 431B: | | | | | |
| Judson | 55 | Somewhat limited | | Somewhat limited | |
| | | Slow water movement | 0.46 | Seepage | 0.53 |
| | | | | Slope | 0.08 |

Sewage Disposal--Continued

| Map symbol and soil name | Pct. of map unit | Septic tank absorption fields: Rating class and limiting features | Value | Sewage lagoons: Rating class and limiting features | Value |
|---|---|---|---|---|---|
| 431B: | | | | | |
| Ackmore, rarely flooded----------- | 25 | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| | | Flooding | 0.40 | Flooding | 0.40 |
| Colo, overwash, frequently flooded | 15 | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 509: | | | | | |
| Marshall, bench----- | 75 | Somewhat limited | | Somewhat limited | |
| | | Slow water movement | 0.46 | Seepage | 0.53 |
| 509B: | | | | | |
| Marshall, bench----- | 90 | Somewhat limited | | Somewhat limited | |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| | | | | Slope | 0.08 |
| 509C: | | | | | |
| Marshall, bench----- | 85 | Somewhat limited | | Very limited | |
| | | Slow water movement | 0.50 | Slope | 1.00 |
| | | | | Seepage | 0.50 |
| 509D2: | | | | | |
| Marshall, bench, moderately eroded-- | 65 | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 630: | | | | | |
| Danbury, occasionally flooded----------- | 80 | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Slow water movement | 0.46 | Seepage | 0.53 |
| 700B: | | | | | |
| Monona, bench------- | 75 | Somewhat limited | | Somewhat limited | |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| | | | | Slope | 0.08 |
| 700C2: | | | | | |
| Monona, bench, moderately eroded-- | 50 | Somewhat limited | | Very limited | |
| | | Slow water movement | 0.50 | Slope | 1.00 |
| | | | | Seepage | 0.50 |

Sewage Disposal--Continued

| Map symbol and soil name | Pct. of map unit | Septic tank absorption fields | | Sewage lagoons | |
|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 700D2: | | | | | |
| Monona, bench, moderately eroded-- | 60 | Somewhat limited | | Very limited | |
| | | Slope | 0.63 | Slope | 1.00 |
| | | Slow water movement | 0.50 | Seepage | 0.50 |
| 5010: | | | | | |
| Pits, sand and gravel------------- | 100 | Not rated | | Not rated | |
| 5040: | | | | | |
| Udorthents, loamy--- | 100 | Not rated | | Not rated | |
| 5080: | | | | | |
| Udorthents, sanitary landfill----------- | 100 | Not rated | | Not rated | |
| AW: | | | | | |
| Animal waste lagoon | 100 | Not rated | | Not rated | |
| SL: | | | | | |
| Sewage lagoon------- | 100 | Not rated | | Not rated | |
| W: | | | | | |
| Water--------------- | 100 | Not rated | | Not rated | |

## Landfills

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

| Map symbol and soil name | Pct. of map unit | Trench sanitary landfill | | Area sanitary landfill | | Daily cover for landfill | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 1C3: | | | | | | | |
| Ida, severely eroded | 80 | Not limited | | Not limited | | Not limited | |
| 1D3: | | | | | | | |
| Ida, severely eroded | 80 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |
| 1E3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 1F3: | | | | | | | |
| Ida, severely eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 8B: | | | | | | | |
| Judson-------------- | 80 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 8C: | | | | | | | |
| Judson-------------- | 95 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 9: | | | | | | | |
| Marshall------------ | 95 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 9B: | | | | | | | |
| Marshall------------ | 100 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 9C2: | | | | | | | |
| Marshall, moderately eroded------------ | 80 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 9D2: | | | | | | | |
| Marshall, moderately eroded------------ | 70 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 10C2: | | | | | | | |
| Monona, moderately eroded------------ | 75 | Not limited | | Not limited | | Not limited | |
| 10D2: | | | | | | | |
| Monona, moderately eroded------------ | 60 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |

Landfills--Continued

| Map symbol and soil name | Pct. of map unit | Trench sanitary landfill | | Area sanitary landfill | | Daily cover for landfill | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 10E2: | | | | | | | |
| Monona, moderately eroded | 40 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 10F2: | | | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 12B: | | | | | | | |
| Napier | 90 | Not limited | | Not limited | | Not limited | |
| 12C: | | | | | | | |
| Napier | 95 | Not limited | | Not limited | | Not limited | |
| 24E2: | | | | | | | |
| Shelby, moderately eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 24F2: | | | | | | | |
| Shelby, moderately eroded | 50 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 35D2: | | | | | | | |
| Liston, moderately eroded | 55 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| Burchard, moderately eroded | 35 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 54: | | | | | | | |
| Zook, occasionally flooded | 90 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Depth to saturated zone | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Too clayey | 1.00 |
| | | Too clayey | 1.00 | | | Hard to compact | 1.00 |
| 54+: | | | | | | | |
| Zook, overwash, occasionally flooded | 85 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Depth to saturated zone | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Too clayey | 1.00 |
| | | Too clayey | 1.00 | | | Hard to compact | 1.00 |

Landfills--Continued

| Map symbol and soil name | Pct. of map unit | Trench sanitary landfill | | Area sanitary landfill | | Daily cover for landfill | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 59E2: | | | | | | | |
| Burchard, moderately eroded------------- | 75 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 59F2: | | | | | | | |
| Burchard, moderately eroded------------- | 80 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 93D2: | | | | | | | |
| Shelby, moderately eroded------------- | 65 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| Adair, moderately eroded------------- | 20 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 99D2: | | | | | | | |
| Exira, moderately eroded------------- | 50 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |
| | | | | | | Too clayey | 0.50 |
| 99E2: | | | | | | | |
| Exira, moderately eroded------------- | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | | | | | Too clayey | 0.50 |
| 99F2: | | | | | | | |
| Exira, moderately eroded------------- | 50 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| | | | | | | Too clayey | 0.50 |
| 100B: | | | | | | | |
| Monona-------------- | 55 | Not limited | | Not limited | | Not limited | |
| 100C2: | | | | | | | |
| Monona, moderately eroded------------- | 55 | Not limited | | Not limited | | Not limited | |
| 100D2: | | | | | | | |
| Monona, moderately eroded------------- | 45 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |
| 100D3: | | | | | | | |
| Monona, severely eroded------------- | 45 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |

Landfills--Continued

| Map symbol and soil name | Pct. of map unit | Trench sanitary landfill | | Area sanitary landfill | | Daily cover for landfill | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 100E2: | | | | | | | |
| Monona, moderately eroded | 45 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 100F2: | | | | | | | |
| Monona, moderately eroded | 55 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 101F3: | | | | | | | |
| Monona, moderately eroded | 40 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| Ida, severely eroded | 30 | Very limited | | Very limited | | Very limited | |
| | | Slope | 1.00 | Slope | 1.00 | Slope | 1.00 |
| 212: | | | | | | | |
| Kennebec, occasionally flooded | 70 | Very limited | | Very limited | | Somewhat limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Too clayey | 0.50 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | | |
| | | Too clayey | 0.50 | | | | |
| 220: | | | | | | | |
| Nodaway, occasionally flooded | 75 | Very limited | | Very limited | | Somewhat limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Too clayey | 0.50 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | | |
| | | Too clayey | 0.50 | | | | |
| 222D2: | | | | | | | |
| Clarinda, moderately eroded | 70 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Too clayey | 1.00 | Slope | 0.63 | Too clayey | 1.00 |
| | | Slope | 0.63 | | | Hard to compact | 1.00 |
| 430: | | | | | | | |
| Ackmore, occasionally flooded | 75 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Depth to saturated zone | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Too clayey | 0.50 |
| | | Too clayey | 0.50 | | | | |
| 431B: | | | | | | | |
| Judson | 55 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |

Landfills--Continued

| Map symbol and soil name | Pct. of map unit | Trench sanitary landfill | | Area sanitary landfill | | Daily cover for landfill | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 431B: | | | | | | | |
| Ackmore, rarely flooded----------- | 25 | Very limited | | Very limited | | Very limited | |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 |
| | | Too clayey | 0.50 | Flooding | 0.40 | Too clayey | 0.50 |
| | | Flooding | 0.40 | | | | |
| Colo, overwash, frequently flooded | 15 | Very limited | | Very limited | | Very limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Depth to saturated zone | 1.00 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Too clayey | 0.50 |
| | | Too clayey | 0.50 | | | | |
| 509: | | | | | | | |
| Marshall, bench----- | 75 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 509B: | | | | | | | |
| Marshall, bench----- | 90 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 509C: | | | | | | | |
| Marshall, bench----- | 85 | Somewhat limited | | Not limited | | Somewhat limited | |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 509D2: | | | | | | | |
| Marshall, bench, moderately eroded-- | 65 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |
| | | Too clayey | 0.50 | | | Too clayey | 0.50 |
| 630: | | | | | | | |
| Danbury, occasionally flooded----------- | 80 | Very limited | | Very limited | | Somewhat limited | |
| | | Flooding | 1.00 | Flooding | 1.00 | Depth to saturated zone | 0.86 |
| | | Depth to saturated zone | 1.00 | Depth to saturated zone | 1.00 | Too clayey | 0.50 |
| | | Too clayey | 0.50 | | | | |
| 700B: | | | | | | | |
| Monona, bench------- | 75 | Not limited | | Not limited | | Not limited | |
| 700C2: | | | | | | | |
| Monona, bench, moderately eroded-- | 50 | Not limited | | Not limited | | Not limited | |
| 700D2: | | | | | | | |
| Monona, bench, moderately eroded-- | 60 | Somewhat limited | | Somewhat limited | | Somewhat limited | |
| | | Slope | 0.63 | Slope | 0.63 | Slope | 0.63 |
| 5010: | | | | | | | |
| Pits, sand and gravel------------ | 100 | Not rated | | Not rated | | Not rated | |

Landfills--Continued

| Map symbol and soil name | Pct. of map unit | Trench sanitary landfill | | Area sanitary landfill | | Daily cover for landfill | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 5040: | | | | | | | |
| Udorthents, loamy--- | 100 | Not rated | | Not rated | | Not rated | |
| 5080: | | | | | | | |
| Udorthents, sanitary landfill----------- | 100 | Not rated | | Not rated | | Not rated | |
| AW: | | | | | | | |
| Animal waste lagoon | 100 | Not rated | | Not rated | | Not rated | |
| SL: | | | | | | | |
| Sewage lagoon------- | 100 | Not rated | | Not rated | | Not rated | |
| W: | | | | | | | |
| Water--------------- | 100 | Not rated | | Not rated | | Not rated | |

## Construction Materials

The titles of the tables described in this section are:

- “Source of Sand and Gravel”
- “Source of Reclamation Material, Roadfill, and Topsoil”

These tables give information about the soils as potential sources of gravel, sand, reclamation material, roadfill, and topsoil. Normal compaction, minor processing, and other standard construction practices are assumed.

*Gravel* and *sand* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the table “Source of Sand and Gravel,” only the likelihood of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material. The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the Unified classification of the soil), the thickness of suitable material, and the content of rock fragments. If the bottom layer of the soil contains sand or gravel, the soil is considered a likely source regardless of thickness. The assumption is that the sand or gravel layer below the depth of observation exceeds the minimum thickness.

The soils are rated as *improbable, possible, probable,* or *very likely* sources of gravel. The bottom layer and the thickest layer of the soils are assigned numerical ratings. These ratings indicate the likelihood that the layer is a source of gravel. The number 0.00 indicates an improbable source; 0.01 to 0.39, a possible source; 0.40 to 0.99, a probable source; and 1.00, a very likely source.

The soils are rated *good, fair,* or *poor* as potential sources of sand. A rating of good or fair means that the source material is likely to be in or below the soil. The bottom layer and the thickest layer of the soils are assigned numerical ratings. The larger the number, the greater the likelihood that the layer is a source of sand.

In the table “Source of Reclamation Material, Roadfill, and Topsoil,” the rating class terms are *good, fair,* and *poor*. The features that limit the soils as sources of these materials are specified in the tables. The numerical ratings given after the specified features indicate the degree to which the features limit the soils as sources of reclamation material, roadfill, and topsoil. The lower the number, the greater the limitation.

*Reclamation material* is used in areas that have been drastically disturbed by surface mining or similar activities. When these areas are reclaimed, layers of soil material or unconsolidated geological material, or both, are replaced in a vertical sequence. The reconstructed soil favors plant growth. The ratings in the table do not apply to quarries and other mined areas that require an offsite source of reconstruction material. The ratings are based on the soil properties that affect erosion and stability of the surface and the productive potential of the reconstructed soil. These properties include the content of sodium, salts, and calcium carbonate; reaction; available water capacity; erodibility; texture; content of rock fragments; and content of organic matter and other features that affect fertility.

*Roadfill* is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the whole soil, from the surface to a depth of about 5 feet. It is assumed that soil layers will be mixed when the soil material is excavated and spread.

The ratings are based on the amount of suitable material and on soil properties that affect the ease of excavation and the performance of the material after it is in place. The thickness of the suitable material is a major consideration. The ease of excavation

is affected by large stones, depth to a water table, and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the AASHTO classification of the soil) and linear extensibility (shrink-swell potential).

*Topsoil* is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area. The ratings are based on the soil properties that affect plant growth; the ease of excavating, loading, and spreading the material; and reclamation of the borrow area. Toxic substances, soil reaction, and the properties that are inferred from soil texture, such as available water capacity and fertility, affect plant growth. The ease of excavating, loading, and spreading is affected by rock fragments, slope, depth to a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, depth to a water table, rock fragments, depth to bedrock or a cemented pan, and toxic material.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Source of Sand and Gravel

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The ratings given for the thickest layer are for the thickest layer above and excluding the bottom layer. The numbers in the value columns range from 0.00 to 0.99. The greater the value, the greater the likelihood that the bottom layer or thickest layer of the soil is a source of sand or gravel. See text for further explanation of ratings in this table)

| Map symbol and soil name | Pct. of map unit | Potential as source of gravel | | Potential as source of sand | |
|---|---|---|---|---|---|
| | | Rating class | Value | Rating class | Value |
| 1C3: | | | | | |
| Ida, severely eroded | 80 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 1D3: | | | | | |
| Ida, severely eroded | 80 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 1E3: | | | | | |
| Ida, severely eroded | 70 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 1F3: | | | | | |
| Ida, severely eroded | 70 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 8B: | | | | | |
| Judson-------------- | 80 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 8C: | | | | | |
| Judson-------------- | 95 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 9: | | | | | |
| Marshall------------ | 95 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 9B: | | | | | |
| Marshall------------ | 100 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 9C2: | | | | | |
| Marshall, moderately eroded------------- | 80 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 9D2: | | | | | |
| Marshall, moderately eroded------------- | 70 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |

Source of Sand and Gravel--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of gravel | | Potential as source of sand | |
|---|---|---|---|---|---|
| | | Rating class | Value | Rating class | Value |
| 10C2: | | | | | |
| Monona, moderately eroded | 75 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 10D2: | | | | | |
| Monona, moderately eroded | 60 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 10E2: | | | | | |
| Monona, moderately eroded | 40 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 10F2: | | | | | |
| Monona, moderately eroded | 45 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 12B: | | | | | |
| Napier | 90 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 12C: | | | | | |
| Napier | 95 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 24E2: | | | | | |
| Shelby, moderately eroded | 70 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 24F2: | | | | | |
| Shelby, moderately eroded | 50 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 35D2: | | | | | |
| Liston, moderately eroded | 55 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| Burchard, moderately eroded | 35 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |

Source of Sand and Gravel--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of gravel | | Potential as source of sand | |
|---|---|---|---|---|---|
| | | Rating class | Value | Rating class | Value |
| 54: | | | | | |
| Zook, occasionally flooded------------ | 90 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 54+: | | | | | |
| Zook, overwash, occasionally flooded------------ | 85 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 59E2: | | | | | |
| Burchard, moderately eroded------------- | 75 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 59F2: | | | | | |
| Burchard, moderately eroded------------- | 80 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 93D2: | | | | | |
| Shelby, moderately eroded------------- | 65 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| Adair, moderately eroded------------- | 20 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 99D2: | | | | | |
| Exira, moderately eroded------------- | 50 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 99E2: | | | | | |
| Exira, moderately eroded------------- | 45 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 99F2: | | | | | |
| Exira, moderately eroded------------- | 50 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 100B: | | | | | |
| Monona-------------- | 55 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |

Source of Sand and Gravel--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of gravel | | Potential as source of sand | |
|---|---|---|---|---|---|
| | | Rating class | Value | Rating class | Value |
| 100C2: | | | | | |
| Monona, moderately eroded------------ | 55 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 100D2: | | | | | |
| Monona, moderately eroded------------ | 45 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 100D3: | | | | | |
| Monona, severely eroded------------ | 45 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 100E2: | | | | | |
| Monona, moderately eroded------------ | 45 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 100F2: | | | | | |
| Monona, moderately eroded------------ | 55 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 101F3: | | | | | |
| Monona, moderately eroded------------ | 40 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| Ida, severely eroded | 30 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 212: | | | | | |
| Kennebec, occasionally flooded----------- | 70 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 220: | | | | | |
| Nodaway, occasionally flooded----------- | 75 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 222D2: | | | | | |
| Clarinda, moderately eroded------------ | 70 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |

Source of Sand and Gravel--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of gravel | | Potential as source of sand | |
|---|---|---|---|---|---|
| | | Rating class | Value | Rating class | Value |
| 430: | | | | | |
| Ackmore, occasionally flooded----------- | 75 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 431B: | | | | | |
| Judson------------- | 55 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| Ackmore, rarely flooded----------- | 25 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| Colo, overwash, frequently flooded | 15 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 509: | | | | | |
| Marshall, bench----- | 75 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 509B: | | | | | |
| Marshall, bench----- | 90 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 509C: | | | | | |
| Marshall, bench----- | 85 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 509D2: | | | | | |
| Marshall, bench, moderately eroded-- | 65 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 630: | | | | | |
| Danbury, occasionally flooded----------- | 80 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 700B: | | | | | |
| Monona, bench------- | 75 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 700C2: | | | | | |
| Monona, bench, moderately eroded-- | 50 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |

Source of Sand and Gravel--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of gravel | | Potential as source of sand | |
|---|---|---|---|---|---|
| | | Rating class | Value | Rating class | Value |
| 700D2: | | | | | |
| Monona, bench, moderately eroded-- | 60 | Improbable | | Poor | |
| | | Thickest layer | 0.00 | Bottom layer | 0.00 |
| | | Bottom layer | 0.00 | Thickest layer | 0.00 |
| 5010: | | | | | |
| Pits, sand and gravel------------ | 100 | Not rated | | Not rated | |
| 5040: | | | | | |
| Udorthents, loamy--- | 100 | Not rated | | Not rated | |
| 5080: | | | | | |
| Udorthents, sanitary landfill----------- | 100 | Not rated | | Not rated | |
| AW: | | | | | |
| Animal waste lagoon | 100 | Not rated | | Not rated | |
| SL: | | | | | |
| Sewage lagoon------- | 100 | Not rated | | Not rated | |
| W: | | | | | |
| Water--------------- | 100 | Not rated | | Not rated | |

Source of Reclamation Material, Roadfill, and Topsoil

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.00 to 0.99. The smaller the value, the greater the limitation. See text for further explanation of ratings in this table)

| Map symbol and soil name | Pct. of map unit | Potential as source of reclamation material | | Potential as source of roadfill | | Potential as source of topsoil | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 1C3: | | | | | | | |
| Ida, severely eroded | 80 | Fair | | Good | | Good | |
| | | Organic matter content | 0.12 | | | | |
| | | Water erosion | 0.90 | | | | |
| | | Carbonate content | 0.97 | | | | |
| 1D3: | | | | | | | |
| Ida, severely eroded | 80 | Fair | | Good | | Fair | |
| | | Organic matter content | 0.12 | | | Slope | 0.37 |
| | | Water erosion | 0.90 | | | | |
| | | Carbonate content | 0.97 | | | | |
| 1E3: | | | | | | | |
| Ida, severely eroded | 70 | Fair | | Fair | | Poor | |
| | | Organic matter content | 0.12 | Slope | 0.92 | Slope | 0.00 |
| | | Water erosion | 0.90 | | | | |
| | | Carbonate content | 0.97 | | | | |
| 1F3: | | | | | | | |
| Ida, severely eroded | 70 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.12 | Slope | 0.00 | Slope | 0.00 |
| | | Water erosion | 0.90 | | | | |
| | | Carbonate content | 0.97 | | | | |
| 8B: | | | | | | | |
| Judson-------------- | 80 | Fair | | Fair | | Fair | |
| | | Too clayey | 0.88 | Shrink-swell | 0.87 | Too clayey | 0.88 |
| | | Water erosion | 0.90 | | | | |
| 8C: | | | | | | | |
| Judson-------------- | 95 | Fair | | Fair | | Fair | |
| | | Too clayey | 0.88 | Shrink-swell | 0.87 | Too clayey | 0.88 |
| | | Water erosion | 0.90 | | | | |
| 9: | | | | | | | |
| Marshall------------ | 95 | Fair | | Fair | | Fair | |
| | | Organic matter content | 0.50 | Shrink-swell | 0.97 | Too clayey | 0.65 |
| | | Water erosion | 0.90 | | | | |
| | | Too clayey | 0.99 | | | | |
| 9B: | | | | | | | |
| Marshall------------ | 100 | Fair | | Fair | | Fair | |
| | | Organic matter content | 0.50 | Shrink-swell | 0.97 | Too clayey | 0.65 |
| | | Water erosion | 0.90 | | | | |
| | | Too clayey | 0.99 | | | | |

Source of Reclamation Material, Roadfill, and Topsoil--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of reclamation material: Rating class and limiting features | Value | Potential as source of roadfill: Rating class and limiting features | Value | Potential as source of topsoil: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 9C2: | | | | | | | |
| Marshall, moderately eroded | 80 | Fair | | Fair | | Fair | |
| | | Too clayey | 0.99 | Shrink-swell | 0.87 | Too clayey | 0.87 |
| 9D2: | | | | | | | |
| Marshall, moderately eroded | 70 | Fair | | Poor | | Fair | |
| | | Too clayey | 0.99 | Low strength | 0.00 | Slope | 0.37 |
| | | | | Shrink-swell | 0.87 | Too clayey | 0.87 |
| 10C2: | | | | | | | |
| Monona, moderately eroded | 75 | Fair | | Poor | | Good | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | | |
| | | Water erosion | 0.90 | | | | |
| 10D2: | | | | | | | |
| Monona, moderately eroded | 60 | Fair | | Poor | | Fair | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | Slope | 0.37 |
| | | Water erosion | 0.90 | | | | |
| 10E2: | | | | | | | |
| Monona, moderately eroded | 40 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | Slope | 0.00 |
| | | | | Slope | 0.92 | | |
| | | Water erosion | 0.90 | | | | |
| 10F2: | | | | | | | |
| Monona, moderately eroded | 45 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | Slope | 0.00 |
| | | | | Slope | 0.00 | | |
| | | Water erosion | 0.90 | | | | |
| 12B: | | | | | | | |
| Napier | 90 | Fair | | Good | | Good | |
| | | Water erosion | 0.90 | | | | |
| 12C: | | | | | | | |
| Napier | 95 | Fair | | Good | | Good | |
| | | Water erosion | 0.90 | | | | |
| 24E2: | | | | | | | |
| Shelby, moderately eroded | 70 | Fair | | Poor | | Poor | |
| | | Too clayey | 0.88 | Low strength | 0.00 | Slope | 0.00 |
| | | Too acid | 0.97 | Shrink-swell | 0.87 | Too clayey | 0.77 |
| | | | | Slope | 0.98 | Rock fragments | 0.95 |

Source of Reclamation Material, Roadfill, and Topsoil--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of reclamation material | | Potential as source of roadfill | | Potential as source of topsoil | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 24F2: | | | | | | | |
| Shelby, moderately eroded------------ | 50 | Fair | | Poor | | Poor | |
| | | Too clayey | 0.88 | Low strength | 0.00 | Slope | 0.00 |
| | | Too acid | 0.97 | Slope | 0.18 | Too clayey | 0.77 |
| | | | | Shrink-swell | 0.87 | Rock fragments | 0.95 |
| 35D2: | | | | | | | |
| Liston, moderately eroded------------ | 55 | Good | | Poor | | Fair | |
| | | | | Low strength | 0.00 | Slope | 0.37 |
| | | | | Shrink-swell | 0.87 | | |
| Burchard, moderately eroded------------ | 35 | Fair | | Poor | | Fair | |
| | | Organic matter content | 0.88 | Low strength | 0.00 | Slope | 0.37 |
| | | | | Shrink-swell | 0.87 | Too clayey | 0.70 |
| | | Too clayey | 0.98 | | | Rock fragments | 0.92 |
| 54: | | | | | | | |
| Zook, occasionally flooded----------- | 90 | Poor | | Poor | | Poor | |
| | | Too clayey | 0.00 | Wetness | 0.00 | Wetness | 0.00 |
| | | Water erosion | 0.99 | Shrink-swell | 0.12 | Too clayey | 0.00 |
| 54+: | | | | | | | |
| Zook, overwash, occasionally flooded----------- | 85 | Poor | | Poor | | Poor | |
| | | Too clayey | 0.00 | Wetness | 0.00 | Wetness | 0.00 |
| | | | | Shrink-swell | 0.12 | Too clayey | 0.00 |
| 59E2: | | | | | | | |
| Burchard, moderately eroded------------ | 75 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.88 | Low strength | 0.00 | Slope | 0.00 |
| | | | | Shrink-swell | 0.87 | Too clayey | 0.70 |
| | | Too clayey | 0.98 | Slope | 0.98 | Rock fragments | 0.92 |
| 59F2: | | | | | | | |
| Burchard, moderately eroded------------ | 80 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.88 | Low strength | 0.00 | Slope | 0.00 |
| | | | | Slope | 0.32 | Too clayey | 0.70 |
| | | Too clayey | 0.98 | Shrink-swell | 0.87 | Rock fragments | 0.92 |
| 93D2: | | | | | | | |
| Shelby, moderately eroded------------ | 65 | Fair | | Poor | | Fair | |
| | | Too clayey | 0.88 | Low strength | 0.00 | Slope | 0.37 |
| | | | | Shrink-swell | 0.87 | Too clayey | 0.77 |
| | | | | | | Rock fragments | 0.95 |
| Adair, moderately eroded------------ | 20 | Poor | | Poor | | Poor | |
| | | Too clayey | 0.00 | Wetness | 0.00 | Wetness | 0.00 |
| | | Too acid | 0.80 | Low strength | 0.00 | Too clayey | 0.00 |
| | | Organic matter content | 0.88 | Shrink-swell | 0.16 | Slope | 0.37 |

Source of Reclamation Material, Roadfill, and Topsoil--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of reclamation material: Rating class and limiting features | Value | Potential as source of roadfill: Rating class and limiting features | Value | Potential as source of topsoil: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 99D2: | | | | | | | |
| Exira, moderately eroded------------ | 50 | Fair | | Poor | | Fair | |
| | | Organic matter content | 0.50 | Low strength | 0.00 | Slope | 0.37 |
| | | | | Shrink-swell | 0.87 | | |
| | | Water erosion | 0.90 | | | | |
| 99E2: | | | | | | | |
| Exira, moderately eroded------------ | 45 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.50 | Low strength | 0.00 | Slope | 0.00 |
| | | | | Shrink-swell | 0.87 | | |
| | | Water erosion | 0.90 | Slope | 0.98 | | |
| 99F2: | | | | | | | |
| Exira, moderately eroded------------ | 50 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.50 | Low strength | 0.00 | Slope | 0.00 |
| | | | | Slope | 0.18 | | |
| | | Water erosion | 0.90 | Shrink-swell | 0.87 | | |
| 100B: | | | | | | | |
| Monona-------------- | 55 | Fair | | Poor | | Good | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | | |
| | | Water erosion | 0.90 | | | | |
| 100C2: | | | | | | | |
| Monona, moderately eroded------------ | 55 | Fair | | Poor | | Good | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | | |
| | | Water erosion | 0.90 | | | | |
| 100D2: | | | | | | | |
| Monona, moderately eroded------------ | 45 | Fair | | Poor | | Fair | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | Slope | 0.37 |
| | | Water erosion | 0.90 | | | | |
| 100D3: | | | | | | | |
| Monona, severely eroded------------ | 45 | Fair | | Poor | | Fair | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | Slope | 0.37 |
| | | Water erosion | 0.90 | | | | |
| 100E2: | | | | | | | |
| Monona, moderately eroded------------ | 45 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | Slope | 0.00 |
| | | | | Slope | 0.92 | | |
| | | Water erosion | 0.90 | | | | |

Source of Reclamation Material, Roadfill, and Topsoil--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of reclamation material | | Potential as source of roadfill | | Potential as source of topsoil | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 100F2: | | | | | | | |
| Monona, moderately eroded | 55 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | Slope | 0.00 |
| | | | | Slope | 0.00 | | |
| | | Water erosion | 0.90 | | | | |
| 101F3: | | | | | | | |
| Monona, moderately eroded | 40 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | Slope | 0.00 |
| | | | | Slope | 0.00 | | |
| | | Water erosion | 0.90 | | | | |
| Ida, severely eroded | 30 | Fair | | Poor | | Poor | |
| | | Organic matter content | 0.12 | Slope | 0.00 | Slope | 0.00 |
| | | Water erosion | 0.90 | | | | |
| | | Carbonate content | 0.97 | | | | |
| 212: | | | | | | | |
| Kennebec, occasionally flooded | 70 | Fair | | Poor | | Good | |
| | | Water erosion | 0.90 | Low strength | 0.00 | | |
| | | | | Shrink-swell | 0.87 | | |
| 220: | | | | | | | |
| Nodaway, occasionally flooded | 75 | Fair | | Poor | | Good | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | | |
| | | | | Shrink-swell | 0.87 | | |
| | | Water erosion | 0.90 | | | | |
| 222D2: | | | | | | | |
| Clarinda, moderately eroded | 70 | Poor | | Poor | | Poor | |
| | | Too clayey | 0.00 | Wetness | 0.00 | Too clayey | 0.00 |
| | | Organic matter content | 0.12 | Low strength | 0.00 | Wetness | 0.00 |
| | | | | Shrink-swell | 0.12 | Slope | 0.37 |
| | | Too acid | 0.97 | | | | |
| 430: | | | | | | | |
| Ackmore, occasionally flooded | 75 | Good | | Poor | | Poor | |
| | | | | Wetness | 0.00 | Wetness | 0.00 |
| | | | | Low strength | 0.00 | | |
| | | | | Shrink-swell | 0.33 | | |
| 431B: | | | | | | | |
| Judson | 55 | Fair | | Fair | | Fair | |
| | | Too clayey | 0.88 | Shrink-swell | 0.87 | Too clayey | 0.88 |
| | | Water erosion | 0.90 | | | | |

Source of Reclamation Material, Roadfill, and Topsoil--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of reclamation material | | Potential as source of roadfill | | Potential as source of topsoil | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 431B: | | | | | | | |
| Ackmore, rarely flooded | 25 | Good | | Poor | | Poor | |
| | | | | Wetness | 0.00 | Wetness | 0.00 |
| | | | | Low strength | 0.00 | | |
| | | | | Shrink-swell | 0.33 | | |
| Colo, overwash, frequently flooded | 15 | Fair | | Poor | | Poor | |
| | | Too clayey | 0.88 | Wetness | 0.00 | Wetness | 0.00 |
| | | | | Low strength | 0.00 | Too clayey | 0.88 |
| | | | | Shrink-swell | 0.87 | | |
| 509: | | | | | | | |
| Marshall, bench | 75 | Fair | | Fair | | Fair | |
| | | Organic matter content | 0.50 | Shrink-swell | 0.97 | Too clayey | 0.65 |
| | | Water erosion | 0.90 | | | | |
| | | Too clayey | 0.99 | | | | |
| 509B: | | | | | | | |
| Marshall, bench | 90 | Fair | | Fair | | Fair | |
| | | Organic matter content | 0.50 | Shrink-swell | 0.97 | Too clayey | 0.65 |
| | | Water erosion | 0.90 | | | | |
| | | Too clayey | 0.99 | | | | |
| 509C: | | | | | | | |
| Marshall, bench | 85 | Fair | | Fair | | Fair | |
| | | Organic matter content | 0.50 | Shrink-swell | 0.97 | Too clayey | 0.65 |
| | | Water erosion | 0.90 | | | | |
| | | Too clayey | 0.99 | | | | |
| 509D2: | | | | | | | |
| Marshall, bench, moderately eroded | 65 | Fair | | Poor | | Fair | |
| | | Too clayey | 0.99 | Low strength | 0.00 | Slope | 0.37 |
| | | | | Shrink-swell | 0.87 | Too clayey | 0.87 |
| 630: | | | | | | | |
| Danbury, occasionally flooded | 80 | Good | | Fair | | Fair | |
| | | | | Shrink-swell | 0.45 | Wetness | 0.53 |
| | | | | Wetness | 0.53 | | |
| 700B: | | | | | | | |
| Monona, bench | 75 | Fair | | Poor | | Good | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | | |
| | | Water erosion | 0.90 | | | | |
| 700C2: | | | | | | | |
| Monona, bench, moderately eroded | 50 | Fair | | Poor | | Good | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | | |
| | | Water erosion | 0.90 | | | | |

Source of Reclamation Material, Roadfill, and Topsoil--Continued

| Map symbol and soil name | Pct. of map unit | Potential as source of reclamation material | | Potential as source of roadfill | | Potential as source of topsoil | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 700D2: | | | | | | | |
| Monona, bench, moderately eroded-- | 60 | Fair | | Poor | | Fair | |
| | | Organic matter content | 0.12 | Low strength | 0.00 | Slope | 0.37 |
| | | Water erosion | 0.90 | | | | |
| 5010: | | | | | | | |
| Pits, sand and gravel------------- | 100 | Not rated | | Not rated | | Not rated | |
| 5040: | | | | | | | |
| Udorthents, loamy--- | 100 | Not rated | | Not rated | | Not rated | |
| 5080: | | | | | | | |
| Udorthents, sanitary landfill----------- | 100 | Not rated | | Not rated | | Not rated | |
| AW: | | | | | | | |
| Animal waste lagoon | 100 | Not rated | | Not rated | | Not rated | |
| SL: | | | | | | | |
| Sewage lagoon------- | 100 | Not rated | | Not rated | | Not rated | |
| W: | | | | | | | |
| Water--------------- | 100 | Not rated | | Not rated | | Not rated | |

## Water Management

The table “Ponds and Embankments” gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The ratings are both verbal and numerical. Rating class terms indicate the extent to which the soils are limited by all of the soil features that affect these uses. *Not limited* indicates that the soil has features that are very favorable for the specified use. Good performance and very low maintenance can be expected. *Somewhat limited* indicates that the soil has features that are moderately favorable for the specified use. The limitations can be overcome or minimized by special planning, design, or installation. Fair performance and moderate maintenance can be expected. *Very limited* indicates that the soil has one or more features that are unfavorable for the specified use. The limitations generally cannot be overcome without major soil reclamation, special design, or expensive installation procedures. Poor performance and high maintenance can be expected.

Numerical ratings in the table indicate the severity of individual limitations. The ratings are shown as decimal fractions ranging from 0.01 to 1.00. They indicate gradations between the point at which a soil feature has the greatest negative impact on the use (1.00) and the point at which the soil feature is not a limitation (0.00).

*Pond reservoir areas* hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

*Embankments, dikes, and levees* are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. Embankments that have zoned construction (core and shell) are not considered. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5 feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of stones or boulders, organic matter, or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

*Aquifer-fed excavated ponds* are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil. Depth to bedrock and the content of large stones affect the ease of excavation.

Ponds and Embankments

(The information in this table indicates the dominant soil condition but does not eliminate the need for onsite investigation. The numbers in the value columns range from 0.01 to 1.00. The larger the value, the greater the limitation. See text for further explanation of ratings in this table)

| Map symbol and soil name | Pct. of map unit | Pond reservoir areas | | Embankments, dikes, and levees | | Aquifer-fed excavated ponds | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 1C3: | | | | | | | |
| Ida, severely eroded | 80 | Somewhat limited | | Very limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 1.00 | Depth to water | 1.00 |
| 1D3: | | | | | | | |
| Ida, severely eroded | 80 | Somewhat limited | | Very limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 1.00 | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| 1E3: | | | | | | | |
| Ida, severely eroded | 70 | Somewhat limited | | Very limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 1.00 | Depth to water | 1.00 |
| | | Slope | 0.06 | | | | |
| 1F3: | | | | | | | |
| Ida, severely eroded | 70 | Somewhat limited | | Very limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 1.00 | Depth to water | 1.00 |
| | | Slope | 0.28 | | | | |
| 8B: | | | | | | | |
| Judson-------------- | 80 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.72 | Piping | 0.19 | Depth to water | 1.00 |
| 8C: | | | | | | | |
| Judson-------------- | 95 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.72 | Piping | 0.19 | Depth to water | 1.00 |
| 9: | | | | | | | |
| Marshall------------ | 95 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.70 | | | Depth to water | 1.00 |
| 9B: | | | | | | | |
| Marshall------------ | 100 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.70 | | | Depth to water | 1.00 |
| 9C2: | | | | | | | |
| Marshall, moderately eroded------------- | 80 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.70 | | | Depth to water | 1.00 |
| 9D2: | | | | | | | |
| Marshall, moderately eroded------------- | 70 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.70 | | | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| 10C2: | | | | | | | |
| Monona, moderately eroded------------- | 75 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |

Ponds and Embankments--Continued

| Map symbol and soil name | Pct. of map unit | Pond reservoir areas | | Embankments, dikes, and levees | | Aquifer-fed excavated ponds | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 10D2: | | | | | | | |
| Monona, moderately eroded | 60 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| 10E2: | | | | | | | |
| Monona, moderately eroded | 40 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| | | Slope | 0.06 | | | | |
| 10F2: | | | | | | | |
| Monona, moderately eroded | 45 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| | | Slope | 0.28 | | | | |
| 12B: | | | | | | | |
| Napier | 90 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.72 | Piping | 0.68 | Depth to water | 1.00 |
| 12C: | | | | | | | |
| Napier | 95 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.72 | Piping | 0.68 | Depth to water | 1.00 |
| 24E2: | | | | | | | |
| Shelby, moderately eroded | 70 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.05 | | | Depth to water | 1.00 |
| | | Slope | 0.04 | | | | |
| 24F2: | | | | | | | |
| Shelby, moderately eroded | 50 | Somewhat limited | | Not limited | | Very limited | |
| | | Slope | 0.18 | | | Depth to water | 1.00 |
| | | Seepage | 0.05 | | | | |
| 35D2: | | | | | | | |
| Liston, moderately eroded | 55 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.05 | | | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| Burchard, moderately eroded | 35 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.05 | | | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| 54: | | | | | | | |
| Zook, occasionally flooded | 90 | Somewhat limited | | Very limited | | Somewhat limited | |
| | | Seepage | 0.05 | Depth to saturated zone | 1.00 | Slow refill | 0.95 |
| | | | | | | Cutbanks cave | 0.10 |
| | | | | Hard to pack | 0.96 | | |

Ponds and Embankments--Continued

| Map symbol and soil name | Pct. of map unit | Pond reservoir areas: Rating class and limiting features | Value | Embankments, dikes, and levees: Rating class and limiting features | Value | Aquifer-fed excavated ponds: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 54+: | | | | | | | |
| Zook, overwash, occasionally flooded | 85 | Somewhat limited | | Very limited | | Somewhat limited | |
| | | Seepage | 0.01 | Depth to saturated zone | 1.00 | Slow refill | 0.99 |
| | | | | | | Cutbanks cave | 0.10 |
| | | | | Hard to pack | 1.00 | | |
| 59E2: | | | | | | | |
| Burchard, moderately eroded | 75 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.05 | | | Depth to water | 1.00 |
| | | Slope | 0.04 | | | | |
| 59F2: | | | | | | | |
| Burchard, moderately eroded | 80 | Somewhat limited | | Not limited | | Very limited | |
| | | Slope | 0.15 | | | Depth to water | 1.00 |
| | | Seepage | 0.05 | | | | |
| 93D2: | | | | | | | |
| Shelby, moderately eroded | 65 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.05 | | | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| Adair, moderately eroded | 20 | Somewhat limited | | Very limited | | Very limited | |
| | | Seepage | 0.05 | Depth to saturated zone | 1.00 | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| 99D2: | | | | | | | |
| Exira, moderately eroded | 50 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.70 | | | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| 99E2: | | | | | | | |
| Exira, moderately eroded | 45 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.70 | | | Depth to water | 1.00 |
| | | Slope | 0.04 | | | | |
| 99F2: | | | | | | | |
| Exira, moderately eroded | 50 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.70 | | | Depth to water | 1.00 |
| | | Slope | 0.18 | | | | |
| 100B: | | | | | | | |
| Monona | 55 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| 100C2: | | | | | | | |
| Monona, moderately eroded | 55 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |

Ponds and Embankments--Continued

| Map symbol and soil name | Pct. of map unit | Pond reservoir areas: Rating class and limiting features | Value | Embankments, dikes, and levees: Rating class and limiting features | Value | Aquifer-fed excavated ponds: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 100D2: | | | | | | | |
| Monona, moderately eroded | 45 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| 100D3: | | | | | | | |
| Monona, severely eroded | 45 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| 100E2: | | | | | | | |
| Monona, moderately eroded | 45 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| | | Slope | 0.06 | | | | |
| 100F2: | | | | | | | |
| Monona, moderately eroded | 55 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| | | Slope | 0.28 | | | | |
| 101F3: | | | | | | | |
| Monona, moderately eroded | 40 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| | | Slope | 0.28 | | | | |
| Ida, severely eroded | 30 | Somewhat limited | | Very limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 1.00 | Depth to water | 1.00 |
| | | Slope | 0.28 | | | | |
| 212: | | | | | | | |
| Kennebec, occasionally flooded | 70 | Somewhat limited | | Very limited | | Somewhat limited | |
| | | Seepage | 0.70 | Piping | 0.99 | Depth to saturated zone | 0.81 |
| | | | | | | Slow refill | 0.30 |
| | | | | | | Cutbanks cave | 0.10 |
| 220: | | | | | | | |
| Nodaway, occasionally flooded | 75 | Somewhat limited | | Very limited | | Somewhat limited | |
| | | Seepage | 0.19 | Piping | 1.00 | Slow refill | 0.81 |
| | | | | | | Depth to saturated zone | 0.78 |
| | | | | | | Cutbanks cave | 0.10 |
| 222D2: | | | | | | | |
| Clarinda, moderately eroded | 70 | Somewhat limited | | Very limited | | Very limited | |
| | | Slope | 0.01 | Depth to saturated zone | 1.00 | Depth to water | 1.00 |
| | | | | Hard to pack | 0.99 | | |

Ponds and Embankments--Continued

| Map symbol and soil name | Pct. of map unit | Pond reservoir areas: Rating class and limiting features | Value | Embankments, dikes, and levees: Rating class and limiting features | Value | Aquifer-fed excavated ponds: Rating class and limiting features | Value |
|---|---|---|---|---|---|---|---|
| 430: | | | | | | | |
| Ackmore, occasionally flooded----------- | 75 | Somewhat limited | | Very limited | | Somewhat limited | |
| | | Seepage | 0.70 | Depth to saturated zone | 1.00 | Slow refill | 0.30 |
| | | | | | | Cutbanks cave | 0.10 |
| | | | | Piping | 0.02 | | |
| 431B: | | | | | | | |
| Judson------------- | 55 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.72 | Piping | 0.19 | Depth to water | 1.00 |
| Ackmore, rarely flooded----------- | 25 | Somewhat limited | | Very limited | | Somewhat limited | |
| | | Seepage | 0.70 | Depth to saturated zone | 1.00 | Slow refill | 0.30 |
| | | | | | | Cutbanks cave | 0.10 |
| | | | | Piping | 0.02 | | |
| Colo, overwash, frequently flooded | 15 | Somewhat limited | | Very limited | | Somewhat limited | |
| | | Seepage | 0.70 | Depth to saturated zone | 1.00 | Slow refill | 0.30 |
| | | | | | | Cutbanks cave | 0.10 |
| 509: | | | | | | | |
| Marshall, bench----- | 75 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.72 | | | Depth to water | 1.00 |
| 509B: | | | | | | | |
| Marshall, bench----- | 90 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.70 | | | Depth to water | 1.00 |
| 509C: | | | | | | | |
| Marshall, bench----- | 85 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.70 | | | Depth to water | 1.00 |
| 509D2: | | | | | | | |
| Marshall, bench, moderately eroded-- | 65 | Somewhat limited | | Not limited | | Very limited | |
| | | Seepage | 0.70 | | | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| 630: | | | | | | | |
| Danbury, occasionally flooded----------- | 80 | Somewhat limited | | Very limited | | Somewhat limited | |
| | | Seepage | 0.72 | Depth to saturated zone | 0.99 | Slow refill | 0.28 |
| | | | | | | Cutbanks cave | 0.10 |
| | | | | Piping | 0.02 | Depth to saturated zone | 0.01 |
| 700B: | | | | | | | |
| Monona, bench------- | 75 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| 700C2: | | | | | | | |
| Monona, bench, moderately eroded-- | 50 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |

Ponds and Embankments--Continued

| Map symbol and soil name | Pct. of map unit | Pond reservoir areas | | Embankments, dikes, and levees | | Aquifer-fed excavated ponds | |
|---|---|---|---|---|---|---|---|
| | | Rating class and limiting features | Value | Rating class and limiting features | Value | Rating class and limiting features | Value |
| 700D2: | | | | | | | |
| Monona, bench, moderately eroded-- | 60 | Somewhat limited | | Somewhat limited | | Very limited | |
| | | Seepage | 0.70 | Piping | 0.28 | Depth to water | 1.00 |
| | | Slope | 0.01 | | | | |
| 5010: | | | | | | | |
| Pits, sand and gravel------------- | 100 | Not rated | | Not rated | | Not rated | |
| 5040: | | | | | | | |
| Udorthents, loamy--- | 100 | Not limited | | Not rated | | Not rated | |
| 5080: | | | | | | | |
| Udorthents, sanitary landfill----------- | 100 | Not rated | | Not rated | | Not rated | |
| AW: | | | | | | | |
| Animal waste lagoon | 100 | Not rated | | Not rated | | Not rated | |
| SL: | | | | | | | |
| Sewage lagoon------- | 100 | Not rated | | Not rated | | Not rated | |
| W: | | | | | | | |
| Water--------------- | 100 | Not rated | | Not rated | | Not rated | |

# Soil Properties

Data relating to soil properties are collected during the course of the soil survey.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine particle-size distribution, plasticity, and compaction characteristics.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help to characterize key soils.

The estimates of soil properties are shown in tables. They include engineering index properties, physical and chemical properties, and pertinent soil and water features.

## Engineering Properties

The table described in this section gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

*Depth* to the upper and lower boundaries of each layer is indicated.

*Texture* is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. “Loam,” for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, “gravelly.” Textural terms are defined in the Glossary in Part I.

*Classification* of the soils is determined according to the Unified soil classification system (ASTM) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

*Rock fragments* larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

*Percentage (of soil particles) passing designated sieves* is the percentage of the soil fraction less than 3 inches in diameter based on an ovendry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

*Liquid limit* and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

*References:*

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

American Society for Testing and Materials (ASTM). 2005. Standard classification of soils for engineering purposes. ASTM Standard D2487–00.

Engineering Properties

(Absence of an entry indicates that data were not estimated)

| Map symbol and soil name | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments >10 inches | Fragments 3-10 inches | Percentage passing sieve number-- 4 | 10 | 40 | 200 | Liquid limit | Plas- ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | Pct | | | | | Pct | |
| 1C3: | | | | | | | | | | | | |
| Ida, severely eroded--------- | 0-3 | Silt loam | ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 89-98 | 30-40 | 5-15 |
| | 3-80 | Silt loam | ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 89-96 | 30-40 | 5-15 |
| 1D3: | | | | | | | | | | | | |
| Ida, severely eroded--------- | 0-3 | Silt loam | ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 89-98 | 30-40 | 5-15 |
| | 3-80 | Silt loam | ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 89-96 | 30-40 | 5-15 |
| 1E3: | | | | | | | | | | | | |
| Ida, severely eroded--------- | 0-3 | Silt loam | ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 89-98 | 30-40 | 5-15 |
| | 3-80 | Silt loam | ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 89-96 | 30-40 | 5-15 |
| 1F3: | | | | | | | | | | | | |
| Ida, severely eroded--------- | 0-3 | Silt loam | ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 89-98 | 30-40 | 5-15 |
| | 3-80 | Silt loam | ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 89-96 | 30-40 | 5-15 |
| 8B: | | | | | | | | | | | | |
| Judson---------- | 0-9 | Silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 96-100 | 92-97 | 35-50 | 10-25 |
| | 9-28 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 97-100 | 94-99 | 30-50 | 15-25 |
| | 28-52 | Silt loam, silty clay loam | CL, CL-ML | A-6, A-7, A-4 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 25-50 | 5-25 |
| | 52-60 | Silt loam, silty clay loam | CL, CL-ML | A-6, A-7, A-4 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 25-50 | 5-25 |
| 8C: | | | | | | | | | | | | |
| Judson---------- | 0-9 | Silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 96-100 | 92-97 | 35-50 | 10-25 |
| | 9-28 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 97-100 | 94-99 | 30-50 | 15-25 |
| | 28-52 | Silt loam, silty clay loam | CL, CL-ML | A-6, A-7, A-4 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 25-50 | 5-25 |
| | 52-60 | Silt loam, silty clay loam | CL, CL-ML | A-6, A-7, A-4 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 25-50 | 5-25 |
| 9: | | | | | | | | | | | | |
| Marshall-------- | 0-7 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 7-22 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 22-65 | Silty clay loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 35-50 | 15-25 |
| | 65-80 | Silty clay loam, silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 96-100 | 91-99 | 35-50 | 15-25 |

Engineering Properties--Continued

| Map symbol and soil name | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments: >10 inches | Fragments: 3-10 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | Pct | | | | | Pct | |
| 9B: | | | | | | | | | | | | |
| Marshall-------- | 0-7 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 7-22 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 22-65 | Silty clay loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 35-50 | 15-25 |
| | 65-80 | Silty clay loam, silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 96-100 | 91-99 | 35-50 | 15-25 |
| 9C2: | | | | | | | | | | | | |
| Marshall, moderately eroded--------- | 0-7 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 7-47 | Silty clay loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 35-50 | 15-25 |
| | 47-80 | Silty clay loam, silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 97-100 | 93-100 | 35-50 | 15-25 |
| 9D2: | | | | | | | | | | | | |
| Marshall, moderately eroded--------- | 0-7 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 91-99 | 35-50 | 15-25 |
| | 7-47 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 35-50 | 15-25 |
| | 47-80 | Silty clay loam, silt loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 97-100 | 93-100 | 35-50 | 15-25 |
| 10C2: | | | | | | | | | | | | |
| Monona, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 10D2: | | | | | | | | | | | | |
| Monona, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |

Engineering Properties--Continued

| Map symbol and soil name | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments: >10 inches | Fragments: 3-10 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | Pct | | | | | Pct | |
| 10E2: Monona, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 10F2: Monona, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 12B: Napier---------- | 0-8 | Silt loam | CL | A-4, A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 25-40 | 8-20 |
| | 8-29 | Silt loam | CL | A-4, A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 25-40 | 8-20 |
| | 29-48 | Silt loam | CL | A-4, A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 25-40 | 8-20 |
| | 48-60 | Silt loam | CL | A-4, A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 25-40 | 8-20 |
| 12C: Napier---------- | 0-8 | Silt loam | CL | A-4, A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 25-40 | 8-20 |
| | 8-29 | Silt loam | CL | A-4, A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 25-40 | 8-20 |
| | 29-48 | Silt loam | CL | A-4, A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 25-40 | 8-20 |
| | 48-60 | Silt loam | CL | A-4, A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 25-40 | 8-20 |
| 24E2: Shelby, moderately eroded--------- | 0-7 | Clay loam | CL | A-6, A-7 | 0 | 0 | 90-95 | 81-95 | 70-90 | 54-71 | 35-45 | 15-25 |
| | 7-33 | Clay loam | CL | A-6, A-7 | 0 | 0 | 90-95 | 81-95 | 72-89 | 56-70 | 35-45 | 15-25 |
| | 33-49 | Clay loam | CL | A-6, A-7 | 0 | 0-4 | 91-95 | 81-95 | 72-89 | 56-70 | 30-45 | 15-25 |
| | 49-80 | Clay loam | CL | A-6, A-7 | 0 | 0-4 | 91-95 | 81-95 | 72-89 | 56-70 | 30-45 | 15-25 |
| 24F2: Shelby, moderately eroded--------- | 0-7 | Clay loam | CL | A-6, A-7 | 0 | 0 | 90-95 | 81-95 | 70-90 | 54-71 | 35-45 | 15-25 |
| | 7-33 | Clay loam | CL | A-6, A-7 | 0 | 0 | 90-95 | 81-95 | 72-89 | 56-70 | 35-45 | 15-25 |
| | 33-49 | Clay loam | CL | A-6, A-7 | 0 | 0-4 | 91-95 | 81-95 | 72-89 | 56-70 | 30-45 | 15-25 |
| | 49-80 | Clay loam | CL | A-6, A-7 | 0 | 0-4 | 91-95 | 81-95 | 72-89 | 56-70 | 30-45 | 15-25 |

Engineering Properties--Continued

| Map symbol and soil name | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments: >10 inches | Fragments: 3-10 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | Pct | | | | | Pct | |
| 35D2: | | | | | | | | | | | | |
| Liston, moderately eroded--------- | 0-5 | Loam, clay loam | CL | A-6, A-7 | 0 | 0-5 | 95-100 | 95-100 | 85-100 | 55-90 | 30-50 | 15-25 |
| | 5-38 | Clay loam | CL | A-6, A-7 | 0 | 0-5 | 95-100 | 95-100 | 90-100 | 70-90 | 30-55 | 12-30 |
| | 38-80 | Loam, clay loam | CL | A-6, A-7 | 0 | 0-5 | 95-100 | 95-100 | 90-100 | 60-75 | 25-55 | 10-30 |
| Burchard, moderately eroded--------- | 0-7 | Clay loam | CL | A-7, A-6 | 0 | 0-5 | 95-100 | 90-100 | 78-92 | 58-70 | 35-50 | 14-24 |
| | 7-13 | Clay loam | CL | A-7, A-6 | 0 | 0-5 | 95-100 | 77-100 | 67-95 | 51-75 | 35-50 | 20-30 |
| | 13-52 | Clay loam | CL | A-7, A-6 | 0 | 0-5 | 95-100 | 77-100 | 67-95 | 50-73 | 35-50 | 15-30 |
| | 52-80 | Clay loam | CL | A-7, A-6 | 0 | 0-5 | 95-100 | 77-100 | 65-92 | 50-72 | 35-50 | 15-30 |
| 54: | | | | | | | | | | | | |
| Zook, occasionally flooded-------- | 0-6 | Silty clay loam | CL | A-7 | 0 | 0 | 100 | 100 | 93-98 | 83-88 | 45-65 | 20-35 |
| | 6-20 | Silty clay loam | CL | A-7 | 0 | 0 | 100 | 100 | 93-98 | 83-88 | 45-65 | 20-35 |
| | 20-52 | Silty clay, silty clay loam | CH | A-7 | 0 | 0 | 100 | 100 | 93-100 | 83-92 | 60-85 | 35-55 |
| | 52-60 | Silty clay loam, silty clay | ML | A-6, A-7 | 0 | 0 | 100 | 100 | 86-100 | 80-98 | 35-80 | 10-50 |
| 54+: | | | | | | | | | | | | |
| Zook, overwash, occasionally flooded-------- | 0-9 | Silt loam | CH | A-7 | 0 | 0 | 100 | 100 | 94-100 | 90-96 | 60-85 | 35-55 |
| | 9-23 | Silty clay loam | CH | A-7 | 0 | 0 | 100 | 100 | 97-100 | 92-100 | 60-85 | 35-55 |
| | 23-64 | Silty clay, silty clay loam | CH | A-7 | 0 | 0 | 100 | 100 | 95-100 | 90-99 | 60-85 | 35-55 |
| | 64-80 | Silty clay loam, silty clay | CH, CL, ML, MH | A-7, A-6 | 0 | 0 | 100 | 100 | 94-100 | 90-100 | 35-80 | 10-50 |
| 59E2: | | | | | | | | | | | | |
| Burchard, moderately eroded--------- | 0-7 | Clay loam | CL | A-7, A-6 | 0 | 0-4 | 95-100 | 90-100 | 78-92 | 58-70 | 35-50 | 14-24 |
| | 7-13 | Clay loam | CL | A-7, A-6 | 0 | 0-4 | 95-100 | 77-100 | 67-95 | 51-75 | 35-50 | 20-30 |
| | 13-52 | Clay loam | CL | A-7, A-6 | 0 | 0-4 | 95-100 | 77-100 | 67-95 | 50-73 | 35-50 | 15-30 |
| | 52-80 | Clay loam | CL | A-7, A-6 | 0 | 0-4 | 95-100 | 77-100 | 65-92 | 50-72 | 35-50 | 15-30 |

Engineering Properties--Continued

| Map symbol and soil name | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments: >10 inches | Fragments: 3-10 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | Pct | | | | | Pct | |
| 59F2: Burchard, moderately eroded--------- | 0-7 | Clay loam | CL | A-7, A-6 | 0 | 0-4 | 95-100 | 90-100 | 78-92 | 58-70 | 35-50 | 14-24 |
| | 7-13 | Clay loam | CL | A-7, A-6 | 0 | 0-4 | 95-100 | 77-100 | 67-95 | 51-75 | 35-50 | 20-30 |
| | 13-52 | Clay loam | CL | A-7, A-6 | 0 | 0-4 | 95-100 | 77-100 | 67-95 | 50-73 | 35-50 | 15-30 |
| | 52-80 | Clay loam | CL | A-7, A-6 | 0 | 0-4 | 95-100 | 77-100 | 65-92 | 50-72 | 35-50 | 15-30 |
| 93D2: Shelby, moderately eroded--------- | 0-7 | Clay loam | CL | A-6, A-7 | 0 | 0 | 90-95 | 81-95 | 70-90 | 54-71 | 35-45 | 15-25 |
| | 7-33 | Clay loam | CL | A-6, A-7 | 0 | 0 | 90-95 | 81-95 | 72-89 | 56-70 | 35-45 | 15-25 |
| | 33-49 | Clay loam | CL | A-6, A-7 | 0 | 0-4 | 91-95 | 81-95 | 72-89 | 56-70 | 30-45 | 15-25 |
| | 49-80 | Clay loam | CL | A-6, A-7 | 0 | 0-4 | 91-95 | 81-95 | 72-89 | 56-70 | 30-45 | 15-25 |
| Adair, moderately eroded--------- | 0-6 | Clay loam | CL | A-6 | 0 | 0 | 95-100 | 77-100 | 69-97 | 55-78 | 30-40 | 10-20 |
| | 6-18 | Clay, clay loam | CL, CH | A-7 | 0 | 0 | 95-100 | 79-100 | 70-97 | 56-78 | 40-55 | 20-30 |
| | 18-33 | Clay, clay loam | CH, CL | A-7 | 0 | 0 | 95-100 | 79-100 | 64-100 | 54-91 | 40-55 | 20-30 |
| | 33-56 | Clay, clay loam | CL, CH | A-7 | 0 | 0 | 95-100 | 79-100 | 70-97 | 56-78 | 40-55 | 20-30 |
| | 56-80 | Clay loam | CL | A-6, A-7 | 0 | 0 | 96-100 | 79-100 | 69-95 | 54-76 | 35-50 | 15-25 |
| 99D2: Exira, moderately eroded--------- | 0-6 | Silty clay loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 96-100 | 92-98 | 35-50 | 15-25 |
| | 6-40 | Silty clay loam, silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 97-100 | 91-100 | 35-50 | 15-25 |
| | 40-80 | Silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 98-100 | 93-97 | 35-50 | 15-25 |
| 99E2: Exira, moderately eroded--------- | 0-6 | Silty clay loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 96-100 | 92-98 | 35-50 | 15-25 |
| | 6-40 | Silty clay loam, silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 97-100 | 91-100 | 35-50 | 15-25 |
| | 40-80 | Silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 98-100 | 93-97 | 35-50 | 15-25 |

Engineering Properties--Continued

| Map symbol and soil name | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments >10 inches | Fragments 3-10 inches | Percentage passing sieve number-- 4 | 10 | 40 | 200 | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | Pct | | | | | Pct | |
| 99F2: Exira, moderately eroded--------- | 0-6 | Silty clay loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 96-100 | 92-98 | 35-50 | 15-25 |
| | 6-40 | Silty clay loam, silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 97-100 | 91-100 | 35-50 | 15-25 |
| | 40-80 | Silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 98-100 | 93-97 | 35-50 | 15-25 |
| 100B: Monona---------- | 0-15 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 15-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 100C2: Monona, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 100D2: Monona, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 100D3: Monona, severely eroded--------- | 0-3 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 3-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |

Engineering Properties--Continued

| Map symbol and soil name | Depth | USDA texture | Classification | | Fragments | | Percentage passing sieve number-- | | | | Liquid limit | Plas- ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | Unified | AASHTO | >10 inches | 3-10 inches | 4 | 10 | 40 | 200 | | |
| | In | | | | Pct | Pct | | | | | Pct | |
| 100E2: | | | | | | | | | | | | |
| Monona, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 100F2: | | | | | | | | | | | | |
| Monona, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 101F3: | | | | | | | | | | | | |
| Monona, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| Ida, severely eroded--------- | 0-3 | Silt loam | ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 89-98 | 30-40 | 5-15 |
| | 3-80 | Silt loam | ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 89-96 | 30-40 | 5-15 |
| 212: | | | | | | | | | | | | |
| Kennebec, occasionally flooded-------- | 0-8 | Silty clay loam, silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 97-100 | 93-98 | 25-45 | 10-20 |
| | 8-54 | Silt loam, silty clay loam | CL, CL-ML | A-6, A-4 | 0 | 0 | 100 | 100 | 96-100 | 92-98 | 25-40 | 5-15 |
| | 54-80 | Silt loam, silty clay loam | CL | A-4, A-6 | 0 | 0 | 100 | 100 | 95-100 | 91-100 | 25-40 | 5-15 |

Engineering Properties--Continued

| Map symbol and soil name | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments: >10 inches | Fragments: 3-10 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plasticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | Pct | | | | | Pct | |
| 220: | | | | | | | | | | | | |
| Nodaway, occasionally flooded-------- | 0-7 | Silt loam | CL | A-6, A-4 | 0 | 0 | 100 | 94-100 | 90-100 | 86-100 | 25-35 | 5-15 |
| | 7-31 | Stratified silt loam to silty clay loam, silt loam, silty clay loam | CL | A-6, A-4 | 0 | 0 | 100 | 94-100 | 88-100 | 84-99 | 25-40 | 5-15 |
| | 31-42 | Stratified silt loam to silty clay loam, silt loam, silty clay loam | CL | A-6, A-4 | 0 | 0 | 100 | 94-100 | 88-100 | 84-100 | 25-40 | 5-15 |
| | 42-80 | Stratified silt loam to silty clay loam, silt loam, silty clay loam | CL | A-6, A-4 | 0 | 0 | 100 | 94-100 | 88-100 | 84-99 | 25-40 | 5-15 |
| 222D2: | | | | | | | | | | | | |
| Clarinda, moderately eroded--------- | 0-7 | Silty clay loam | CL | A-7 | 0 | 0 | 100 | 95-100 | 89-100 | 77-93 | 40-50 | 20-30 |
| | 7-80 | Clay, silty clay | CH | A-7 | 0 | 0 | 95-100 | 90-100 | 81-100 | 78-100 | 55-70 | 35-45 |
| 430: | | | | | | | | | | | | |
| Ackmore, occasionally flooded-------- | 0-6 | Silt loam | ML, CL | A-4, A-7, A-6 | 0 | 0 | 100 | 100 | 95-100 | 90-99 | 25-50 | 8-20 |
| | 6-25 | Silt loam, silty clay loam | CL, ML | A-6, A-4, A-7 | 0 | 0 | 100 | 100 | 94-100 | 88-100 | 25-50 | 8-20 |
| | 25-60 | Silty clay loam, silt loam | CH, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 90-100 | 35-60 | 15-30 |
| 431B: | | | | | | | | | | | | |
| Judson---------- | 0-9 | Silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 96-100 | 92-97 | 35-50 | 10-25 |
| | 9-28 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 97-100 | 94-99 | 30-50 | 15-25 |
| | 28-52 | Silt loam, silty clay loam | CL, CL-ML | A-6, A-7, A-4 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 25-50 | 5-25 |
| | 52-60 | Silt loam, silty clay loam | CL, CL-ML | A-6, A-7, A-4 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 25-50 | 5-25 |
| Ackmore, rarely flooded-------- | 0-6 | Silt loam | ML, CL | A-4, A-7, A-6 | 0 | 0 | 100 | 100 | 95-100 | 90-99 | 25-50 | 8-20 |
| | 6-25 | Silt loam, silty clay loam | CL, ML | A-6, A-4, A-7 | 0 | 0 | 100 | 100 | 94-100 | 88-100 | 25-50 | 8-20 |
| | 25-60 | Silty clay loam, silt loam | CH, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 90-100 | 35-60 | 15-30 |

Engineering Properties--Continued

| Map symbol and soil name | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments: >10 inches | Fragments: 3-10 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plas- ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | Pct | | | | | Pct | |
| 431B: | | | | | | | | | | | | |
| Colo, overwash, frequently flooded-------- | 0-15 | Silt loam | CL, CL-ML | A-6, A-4 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 25-40 | 5-15 |
| | 15-50 | Silty clay loam | CH, CL | A-7 | 0 | 0 | 100 | 100 | 97-100 | 93-98 | 40-55 | 20-30 |
| | 50-70 | Silty clay loam | CH, CL | A-7 | 0 | 0 | 100 | 100 | 96-100 | 92-100 | 40-55 | 15-30 |
| | 70-80 | Silty clay loam | CH, CL | A-7 | 0 | 0 | 100 | 100 | 96-100 | 92-100 | 40-55 | 15-30 |
| 509: | | | | | | | | | | | | |
| Marshall, bench | 0-7 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 7-22 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 22-65 | Silty clay loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 35-50 | 15-25 |
| | 65-80 | Silty clay loam, silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 96-100 | 91-99 | 35-50 | 15-25 |
| 509B: | | | | | | | | | | | | |
| Marshall, bench | 0-7 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 7-22 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 22-65 | Silty clay loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 35-50 | 15-25 |
| | 65-80 | Silty clay loam, silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 96-100 | 91-99 | 35-50 | 15-25 |
| 509C: | | | | | | | | | | | | |
| Marshall, bench | 0-7 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 7-22 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 94-100 | 89-97 | 35-50 | 15-25 |
| | 22-65 | Silty clay loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 35-50 | 15-25 |
| | 65-80 | Silty clay loam, silt loam | CL | A-7, A-6 | 0 | 0 | 100 | 100 | 96-100 | 91-99 | 35-50 | 15-25 |
| 509D2: | | | | | | | | | | | | |
| Marshall, bench, moderately eroded--------- | 0-7 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 91-99 | 35-50 | 15-25 |
| | 7-47 | Silty clay loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 91-98 | 35-50 | 15-25 |
| | 47-80 | Silty clay loam, silt loam | CL | A-6, A-7 | 0 | 0 | 100 | 100 | 97-100 | 93-100 | 35-50 | 15-25 |

Engineering Properties--Continued

| Map symbol and soil name | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments: >10 inches | Fragments: 3-10 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plas- ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | Pct | | | | | Pct | |
| 630: Danbury, occasionally flooded-------- | 0-7 | Silt loam, silty clay loam | ML | A-6 | 0 | 0 | 100 | 100 | 98-100 | 94-98 | 25-50 | 8-20 |
| | 7-32 | Silty clay loam, silt loam | ML | A-6 | 0 | 0 | 100 | 100 | 94-100 | 90-100 | 25-50 | 8-20 |
| | 32-64 | Silty clay loam, silt loam | CL | A-7 | 0 | 0 | 100 | 100 | 94-100 | 90-100 | 35-60 | 15-30 |
| | 64-80 | Silty clay loam, silt loam | CL | A-7 | 0 | 0 | 100 | 100 | 94-100 | 90-100 | 35-60 | 15-30 |
| 700B: Monona, bench--- | 0-15 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 15-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 700C2: Monona, bench, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 700D2: Monona, bench, moderately eroded--------- | 0-7 | Silt loam, silty clay loam | ML, CL | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 7-30 | Silt loam, silty clay loam | CL, ML | A-6, A-7 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 35-50 | 10-25 |
| | 30-60 | Silt loam | CL | A-6 | 0 | 0 | 100 | 100 | 95-100 | 95-100 | 30-40 | 10-20 |
| 5010. Pits, sand and gravel | | | | | | | | | | | | |
| 5040. Udorthents, loamy | | | | | | | | | | | | |

Engineering Properties--Continued

| Map symbol and soil name | Depth | USDA texture | Classification: Unified | Classification: AASHTO | Fragments: >10 inches | Fragments: 3-10 inches | Percentage passing sieve number--: 4 | 10 | 40 | 200 | Liquid limit | Plas- ticity index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | In | | | | Pct | Pct | | | | | Pct | |
| 5080. Udorthents, sanitary landfill | | | | | | | | | | | | |
| AW. Animal waste lagoon | | | | | | | | | | | | |
| SL. Sewage lagoon | | | | | | | | | | | | |
| W. Water | | | | | | | | | | | | |

## Physical Properties

The table described in this section shows estimates of some physical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

*Depth* to the upper and lower boundaries of each layer is indicated.

*Clay* as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In the table, the estimated clay content of each soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay affect the fertility and physical condition of the soil and the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earthmoving operations.

*Moist bulk density* is the weight of soil (ovendry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at $^{1}/_{3}$- or $^{1}/_{10}$-bar (33kPa or 10kPa) moisture tension. Weight is determined after the soil is dried at 105 degrees C. In the table, the estimated moist bulk density of each soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute linear extensibility, shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. Depending on soil texture, a bulk density of more than 1.4 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

*Permeability* refers to the ability of a soil to transmit water or air. The term "permeability," as used in soil surveys, indicates saturated hydraulic conductivity (Ksat). The estimates in the table indicate the rate of water movement, in micrometers per second, when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

*Available water capacity* refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each soil layer. The capacity varies, depending on soil properties that affect retention of water. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

*Linear extensibility* refers to the change in length of an unconfined clod as moisture content is decreased from a moist to a dry state. It is an expression of the volume change between the water content of the clod at $^{1}/_{3}$- or $^{1}/_{10}$-bar tension (33kPa or 10kPa tension) and oven dryness. The volume change is reported in the table as percent change for the whole soil. Volume change is influenced by the amount and type of clay minerals in the soil.

Linear extensibility is used to determine the shrink-swell potential of soils. The shrink-swell potential is low if the soil has a linear extensibility of less than 3 percent; moderate if 3 to 6 percent; high if 6 to 9 percent; and very high if more than 9 percent. If the linear extensibility is more than 3, shrinking and swelling can cause damage to buildings, roads, and other structures and to plant roots. Special design commonly is needed.

*Organic matter* is the plant and animal residue in the soil at various stages of decomposition. In the table, the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter in a soil can be maintained by returning crop residue to the soil. Organic matter has a positive effect on available water capacity, water infiltration, soil organism activity, and tilth. It is a source of nitrogen and other nutrients for crops and soil organisms.

*Erosion factors* are shown in the table as the K factor (Kw and Kf) and the T factor. Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) and the Revised Universal Soil Loss Equation (RUSLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter and on soil structure and permeability. Values of K range from 0.02 to 0.69. Other factors being equal, the higher the value, the more susceptible the soil is to sheet and rill erosion by water.

*Erosion factor Kw* indicates the erodibility of the whole soil. The estimates are modified by the presence of rock fragments.

*Erosion factor Kf* indicates the erodibility of the fine-earth fraction, or the material less than 2 millimeters in size.

*Erosion factor T* is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

*Wind erodibility groups* are made up of soils that have similar properties affecting their susceptibility to wind erosion in cultivated areas. The soils assigned to group 1 are the most susceptible to wind erosion, and those assigned to group 8 are the least susceptible. The groups are described in the “National Soil Survey Handbook,” which is available in local offices of the Natural Resources Conservation Service or on the Internet.

*Wind erodibility index* is a numerical value indicating the susceptibility of soil to wind erosion, or the tons per acre per year that can be expected to be lost to wind erosion. There is a close correlation between wind erosion and the texture of the surface layer, the size and durability of surface clods, rock fragments, organic matter, and a calcareous reaction. Soil moisture and frozen soil layers also influence wind erosion.

Physical Properties of the Soils

(Entries under "Erosion factors--T" apply to the entire profile. Entries under "Wind erodibility group" and "Wind erodibility index" apply only to the surface layer. Absence of an entry indicates that data were not estimated)

| Map symbol and soil name | Pct. of map unit | Depth | Clay | Moist bulk density | Permea- bility | Available water capacity | Linear extensi- bility | Organic matter | Erosion factors | | | Wind erodi- bility group | Wind erodi- bility index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Kw | Kf | T | | |
| | | In | Pct | g/cc | In/hr | In/in | Pct | Pct | | | | | |
| 1C3: | | | | | | | | | | | | | |
| Ida, severely eroded-- | 80 | 0-3 | 18-27 | 1.20-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 1.0-2.0 | .43 | .43 | 4 | 4L | 86 |
| | | 3-80 | 18-25 | 1.20-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 1D3: | | | | | | | | | | | | | |
| Ida, severely eroded-- | 80 | 0-3 | 18-27 | 1.20-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 1.0-2.0 | .43 | .43 | 4 | 4L | 86 |
| | | 3-80 | 18-25 | 1.20-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 1E3: | | | | | | | | | | | | | |
| Ida, severely eroded-- | 70 | 0-3 | 18-27 | 1.20-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 1.0-2.0 | .43 | .43 | 4 | 4L | 86 |
| | | 3-80 | 18-25 | 1.20-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 1F3: | | | | | | | | | | | | | |
| Ida, severely eroded-- | 70 | 0-3 | 18-27 | 1.20-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 1.0-2.0 | .43 | .43 | 4 | 4L | 86 |
| | | 3-80 | 18-25 | 1.20-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 8B: | | | | | | | | | | | | | |
| Judson---------------- | 80 | 0-9 | 27-32 | 1.30-1.35 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 4.0-5.0 | .28 | .28 | 5 | 6 | 38 |
| | | 9-28 | 30-35 | 1.35-1.45 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 3.0-4.0 | .28 | .28 | | | |
| | | 28-52 | 25-32 | 1.35-1.45 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 1.0-2.0 | .43 | .43 | | | |
| | | 52-60 | 25-32 | 1.35-1.45 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 0.5-1.0 | .43 | .43 | | | |
| 8C: | | | | | | | | | | | | | |
| Judson---------------- | 95 | 0-9 | 27-32 | 1.30-1.35 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 4.0-5.0 | .28 | .28 | 5 | 6 | 38 |
| | | 9-28 | 30-35 | 1.35-1.45 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 3.0-4.0 | .28 | .28 | | | |
| | | 28-52 | 25-32 | 1.35-1.45 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 1.0-2.0 | .43 | .43 | | | |
| | | 52-60 | 25-32 | 1.35-1.45 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 0.5-1.0 | .43 | .43 | | | |
| 9: | | | | | | | | | | | | | |
| Marshall-------------- | 95 | 0-7 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 0.0-2.9 | 3.0-4.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-22 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 0.0-2.9 | 2.0-3.0 | .28 | .28 | | | |
| | | 22-65 | 27-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| | | 65-80 | 22-30 | 1.30-1.40 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |
| 9B: | | | | | | | | | | | | | |
| Marshall-------------- | 100 | 0-7 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 0.0-2.9 | 3.0-4.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-22 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 0.0-2.9 | 2.0-3.0 | .28 | .28 | | | |
| | | 22-65 | 27-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| | | 65-80 | 22-30 | 1.30-1.40 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |

Physical Properties of the Soils--Continued

| Map symbol and soil name | Pct. of map unit | Depth | Clay | Moist bulk density | Permea-bility | Available water capacity | Linear extensi-bility | Organic matter | Erosion factors Kw | Kf | T | Wind erodi-bility group | Wind erodi-bility index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | In | Pct | g/cc | In/hr | In/in | Pct | Pct | | | | | |
| 9C2: | | | | | | | | | | | | | |
| Marshall, moderately eroded--------------- | 80 | 0-7 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 5 | 6 | 48 |
| | | 7-47 | 27-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 1.0-2.0 | .32 | .32 | | | |
| | | 47-80 | 23-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| 9D2: | | | | | | | | | | | | | |
| Marshall, moderately eroded--------------- | 70 | 0-7 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 5 | 6 | 38 |
| | | 7-47 | 27-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 1.0-2.0 | .32 | .32 | | | |
| | | 47-80 | 23-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| 10C2: | | | | | | | | | | | | | |
| Monona, moderately eroded--------------- | 75 | 0-7 | 20-27 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 10D2: | | | | | | | | | | | | | |
| Monona, moderately eroded--------------- | 60 | 0-7 | 20-27 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 1.0-2.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 0.5-0.5 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 10E2: | | | | | | | | | | | | | |
| Monona, moderately eroded--------------- | 40 | 0-7 | 20-27 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 10F2: | | | | | | | | | | | | | |
| Monona, moderately eroded--------------- | 45 | 0-7 | 20-27 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 12B: | | | | | | | | | | | | | |
| Napier---------------- | 90 | 0-8 | 20-27 | 1.20-1.25 | 0.6-2 | 0.22-0.24 | 0.0-2.9 | 3.0-4.0 | .28 | .28 | 5 | 6 | 48 |
| | | 8-29 | 20-27 | 1.20-1.25 | 0.6-2 | 0.22-0.24 | 0.0-2.9 | 3.0-3.5 | .28 | .28 | | | |
| | | 29-48 | 20-27 | 1.25-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 1.0-2.0 | .43 | .43 | | | |
| | | 48-60 | 20-27 | 1.25-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |

Physical Properties of the Soils--Continued

| Map symbol and soil name | Pct. of map unit | Depth | Clay | Moist bulk density | Permea- bility | Available water capacity | Linear extensi- bility | Organic matter | Erosion factors Kw | Kf | T | Wind erodi- bility group | Wind erodi- bility index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | In | Pct | g/cc | In/hr | In/in | Pct | Pct | | | | | |
| 12C: | | | | | | | | | | | | | |
| Napier---------------- | 95 | 0-8 | 20-27 | 1.20-1.25 | 0.6-2 | 0.22-0.24 | 0.0-2.9 | 3.0-4.0 | .28 | .28 | 5 | 6 | 48 |
| | | 8-29 | 20-27 | 1.20-1.25 | 0.6-2 | 0.22-0.24 | 0.0-2.9 | 3.0-3.5 | .28 | .28 | | | |
| | | 29-48 | 20-27 | 1.25-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 1.0-2.0 | .43 | .43 | | | |
| | | 48-60 | 20-27 | 1.25-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 24E2: | | | | | | | | | | | | | |
| Shelby, moderately eroded--------------- | 70 | 0-7 | 27-35 | 1.50-1.55 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 5 | 6 | 48 |
| | | 7-33 | 30-35 | 1.50-1.55 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 1.0-2.0 | .28 | .28 | | | |
| | | 33-49 | 30-35 | 1.55-1.65 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 0.0-1.0 | .28 | .28 | | | |
| | | 49-80 | 30-35 | 1.55-1.65 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 0.0-0.5 | .37 | .37 | | | |
| 24F2: | | | | | | | | | | | | | |
| Shelby, moderately eroded--------------- | 50 | 0-7 | 27-35 | 1.50-1.55 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 5 | 6 | 48 |
| | | 7-33 | 30-35 | 1.50-1.55 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 1.0-2.0 | .28 | .28 | | | |
| | | 33-49 | 30-35 | 1.55-1.65 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 0.0-1.0 | .28 | .28 | | | |
| | | 49-80 | 30-35 | 1.55-1.65 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 0.0-0.5 | .37 | .37 | | | |
| 35D2: | | | | | | | | | | | | | |
| Liston, moderately eroded--------------- | 55 | 0-5 | 24-35 | 1.30-1.60 | 0.2-0.6 | 0.17-0.19 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 5 | 4L | 86 |
| | | 5-38 | 27-33 | 1.30-1.60 | 0.2-0.6 | 0.15-0.17 | 3.0-5.9 | 1.0-2.0 | .32 | .32 | | | |
| | | 38-80 | 26-40 | 1.50-1.80 | 0.2-0.6 | 0.14-0.19 | 3.0-5.9 | 0.5-1.0 | .32 | .32 | | | |
| Burchard, moderately eroded--------------- | 35 | 0-7 | 25-30 | 1.40-1.60 | 0.2-0.6 | 0.17-0.19 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-13 | 27-35 | 1.40-1.60 | 0.2-0.6 | 0.15-0.17 | 3.0-5.9 | 1.0-2.0 | .28 | .32 | | | |
| | | 13-52 | 27-35 | 1.40-1.60 | 0.2-0.6 | 0.14-0.16 | 3.0-5.9 | 0.5-1.0 | .28 | .32 | | | |
| | | 52-80 | 23-30 | 1.40-1.60 | 0.2-0.6 | 0.14-0.16 | 3.0-5.9 | 0.5-1.0 | .28 | .32 | | | |
| 54: | | | | | | | | | | | | | |
| Zook, occasionally flooded-------------- | 90 | 0-6 | 35-40 | 1.30-1.35 | 0.2-0.6 | 0.21-0.23 | 6.0-8.9 | 5.0-6.0 | .37 | .37 | 5 | 4 | 38 |
| | | 6-20 | 35-40 | 1.30-1.35 | 0.2-0.6 | 0.21-0.23 | 6.0-8.9 | 4.0-5.0 | .37 | .37 | | | |
| | | 20-52 | 35-45 | 1.30-1.45 | 0.06-0.2 | 0.11-0.13 | 6.0-8.9 | 2.0-4.0 | .28 | .28 | | | |
| | | 52-60 | 27-45 | 1.30-1.45 | 0.06-0.2 | 0.11-0.22 | 6.0-8.9 | 0.0-1.0 | .28 | .28 | | | |
| 54+: | | | | | | | | | | | | | |
| Zook, overwash, occasionally flooded- | 85 | 0-9 | 20-26 | 1.35-1.40 | 0.06-0.2 | 0.11-0.13 | 6.0-8.9 | 4.0-5.0 | .28 | .28 | 5 | 6 | 86 |
| | | 9-23 | 36-40 | 1.30-1.45 | 0.06-0.2 | 0.11-0.13 | 6.0-8.9 | 5.0-6.0 | .28 | .28 | | | |
| | | 23-64 | 36-45 | 1.30-1.45 | 0.06-0.2 | 0.11-0.13 | 6.0-8.9 | 2.0-4.0 | .28 | .28 | | | |
| | | 64-80 | 27-45 | 1.30-1.45 | 0.0000-0.6 | 0.11-0.22 | 6.0-8.9 | 0.0-1.0 | .28 | .28 | | | |

Physical Properties of the Soils--Continued

| Map symbol and soil name | Pct. of map unit | Depth | Clay | Moist bulk density | Permea- bility | Available water capacity | Linear extensi- bility | Organic matter | Erosion factors | | | Wind erodi- bility group | Wind erodi- bility index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Kw | Kf | T | | |
| | | In | Pct | g/cc | In/hr | In/in | Pct | Pct | | | | | |
| 59E2: | | | | | | | | | | | | | |
| Burchard, moderately eroded--------------- | 75 | 0-7 | 25-30 | 1.40-1.60 | 0.2-0.6 | 0.17-0.19 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-13 | 27-35 | 1.40-1.60 | 0.2-0.6 | 0.15-0.17 | 3.0-5.9 | 1.0-2.0 | .28 | .32 | | | |
| | | 13-52 | 27-35 | 1.40-1.60 | 0.2-0.6 | 0.14-0.16 | 3.0-5.9 | 0.5-1.0 | .28 | .32 | | | |
| | | 52-80 | 23-30 | 1.40-1.60 | 0.2-0.6 | 0.14-0.16 | 3.0-5.9 | 0.5-1.0 | .28 | .32 | | | |
| 59F2: | | | | | | | | | | | | | |
| Burchard, moderately eroded--------------- | 80 | 0-7 | 25-30 | 1.40-1.60 | 0.2-0.6 | 0.17-0.19 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-13 | 27-35 | 1.40-1.60 | 0.2-0.6 | 0.15-0.17 | 3.0-5.9 | 1.0-2.0 | .28 | .32 | | | |
| | | 13-52 | 27-35 | 1.40-1.60 | 0.2-0.6 | 0.14-0.16 | 3.0-5.9 | 0.5-1.0 | .28 | .32 | | | |
| | | 52-80 | 23-30 | 1.40-1.60 | 0.2-0.6 | 0.14-0.16 | 3.0-5.9 | 0.5-1.0 | .28 | .32 | | | |
| 93D2: | | | | | | | | | | | | | |
| Shelby, moderately eroded--------------- | 65 | 0-7 | 27-35 | 1.50-1.55 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 5 | 6 | 48 |
| | | 7-33 | 30-35 | 1.50-1.55 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 1.0-2.0 | .28 | .28 | | | |
| | | 33-49 | 30-35 | 1.55-1.65 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 0.0-1.0 | .28 | .28 | | | |
| | | 49-80 | 30-35 | 1.55-1.65 | 0.2-0.6 | 0.16-0.18 | 3.0-5.9 | 0.0-0.5 | .37 | .37 | | | |
| Adair, moderately eroded--------------- | 20 | 0-6 | 35-40 | 1.45-1.50 | 0.2-0.6 | 0.17-0.19 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 3 | 4 | 86 |
| | | 6-18 | 35-42 | 1.55-1.60 | 0.06-0.2 | 0.13-0.16 | 6.0-8.9 | 0.5-1.0 | .32 | .32 | | | |
| | | 18-33 | 38-50 | 1.55-1.60 | 0.06-0.2 | 0.13-0.16 | 6.0-8.9 | 0.5-1.0 | .32 | .32 | | | |
| | | 33-56 | 35-40 | 1.55-1.60 | 0.06-0.2 | 0.13-0.16 | 6.0-8.9 | 0.5-1.0 | .32 | .32 | | | |
| | | 56-80 | 30-38 | 1.60-1.70 | 0.2-0.6 | 0.14-0.16 | 3.0-5.9 | 0.0-0.5 | .32 | .32 | | | |
| 99D2: | | | | | | | | | | | | | |
| Exira, moderately eroded--------------- | 50 | 0-6 | 28-34 | 1.25-1.35 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 5 | 6 | 38 |
| | | 6-40 | 25-35 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| | | 40-80 | 23-27 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |
| 99E2: | | | | | | | | | | | | | |
| Exira, moderately eroded--------------- | 45 | 0-6 | 28-34 | 1.25-1.35 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 5 | 6 | 38 |
| | | 6-40 | 25-35 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| | | 40-80 | 23-27 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |
| 99F2: | | | | | | | | | | | | | |
| Exira, moderately eroded--------------- | 50 | 0-6 | 28-34 | 1.25-1.35 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 5 | 6 | 38 |
| | | 6-40 | 25-35 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| | | 40-80 | 23-27 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |

Physical Properties of the Soils--Continued

| Map symbol and soil name | Pct. of map unit | Depth | Clay | Moist bulk density | Permea- bility | Available water capacity | Linear extensi- bility | Organic matter | Erosion factors | | | Wind erodi- bility group | Wind erodi- bility index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Kw | Kf | T | | |
| | | In | Pct | g/cc | In/hr | In/in | Pct | Pct | | | | | |
| 100B: | | | | | | | | | | | | | |
| Monona---------------- | 55 | 0-15 | 26-35 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 3.0-4.0 | .28 | .28 | 5 | 6 | 38 |
| | | 15-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 100C2: | | | | | | | | | | | | | |
| Monona, moderately eroded-------------- | 55 | 0-7 | 26-35 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 38 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 100D2: | | | | | | | | | | | | | |
| Monona, moderately eroded-------------- | 45 | 0-7 | 26-35 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 38 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 100D3: | | | | | | | | | | | | | |
| Monona, severely eroded-------------- | 45 | 0-3 | 26-35 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 1.0-2.0 | .28 | .28 | 4 | 6 | 38 |
| | | 3-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 0.5-0.5 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 100E2: | | | | | | | | | | | | | |
| Monona, moderately eroded-------------- | 45 | 0-7 | 26-35 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 38 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 100F2: | | | | | | | | | | | | | |
| Monona, moderately eroded-------------- | 55 | 0-7 | 26-35 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 38 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 101F3: | | | | | | | | | | | | | |
| Monona, moderately eroded-------------- | 40 | 0-7 | 20-27 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| Ida, severely eroded-- | 30 | 0-3 | 18-27 | 1.20-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 1.0-2.0 | .43 | .43 | 4 | 4L | 86 |
| | | 3-80 | 18-25 | 1.20-1.30 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |

Physical Properties of the Soils--Continued

| Map symbol and soil name | Pct. of map unit | Depth | Clay | Moist bulk density | Permea- bility | Available water capacity | Linear extensi- bility | Organic matter | Erosion factors Kw | Kf | T | Wind erodi- bility group | Wind erodi- bility index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | In | Pct | g/cc | In/hr | In/in | Pct | Pct | | | | | |
| 212: | | | | | | | | | | | | | |
| Kennebec, occasionally flooded-------------- | 70 | 0-8 | 22-28 | 1.25-1.35 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-4.0 | .28 | .28 | 5 | 6 | 48 |
| | | 8-54 | 24-30 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-2.0 | .43 | .43 | | | |
| | | 54-80 | 24-33 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-2.0 | .43 | .43 | | | |
| 220: | | | | | | | | | | | | | |
| Nodaway, occasionally flooded-------------- | 75 | 0-7 | 18-27 | 1.25-1.35 | 0.1-1 | 0.20-0.23 | 0.0-2.9 | 2.0-4.0 | .32 | .32 | 5 | 6 | 48 |
| | | 7-31 | 18-28 | 1.25-1.35 | 0.1-1 | 0.20-0.23 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |
| | | 31-42 | 18-30 | 1.25-1.35 | 0.1-1 | 0.20-0.23 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |
| | | 42-80 | 18-28 | 1.25-1.35 | 0.1-1 | 0.20-0.23 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |
| 222D2: | | | | | | | | | | | | | |
| Clarinda, moderately eroded--------------- | 70 | 0-7 | 27-38 | 1.45-1.50 | 0.2-0.6 | 0.17-0.19 | 3.0-5.9 | 2.0-3.0 | .37 | .37 | 3 | 6 | 38 |
| | | 7-80 | 40-60 | 1.50-1.65 | 0.0015-0.01 | 0.14-0.16 | 6.0-8.9 | 0.0-0.5 | .37 | .37 | | | |
| 430: | | | | | | | | | | | | | |
| Ackmore, occasionally flooded-------------- | 75 | 0-6 | 18-27 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 2.0-4.0 | .32 | .32 | 5 | 6 | 48 |
| | | 6-25 | 18-30 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 1.0-3.0 | .32 | .32 | | | |
| | | 25-60 | 26-38 | 1.30-1.40 | 0.6-2 | 0.18-0.20 | 6.0-8.9 | 3.0-5.0 | .32 | .32 | | | |
| 431B: | | | | | | | | | | | | | |
| Judson---------------- | 55 | 0-9 | 27-32 | 1.30-1.35 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 4.0-5.0 | .28 | .28 | 5 | 6 | 38 |
| | | 9-28 | 30-35 | 1.35-1.45 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 3.0-4.0 | .28 | .28 | | | |
| | | 28-52 | 25-32 | 1.35-1.45 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 1.0-2.0 | .43 | .43 | | | |
| | | 52-60 | 25-32 | 1.35-1.45 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 0.5-1.0 | .43 | .43 | | | |
| Ackmore, rarely flooded-------------- | 25 | 0-6 | 18-27 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 2.0-4.0 | .32 | .32 | 5 | 6 | 48 |
| | | 6-25 | 18-30 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 1.0-3.0 | .32 | .32 | | | |
| | | 25-60 | 26-38 | 1.30-1.40 | 0.6-2 | 0.18-0.20 | 6.0-8.9 | 3.0-5.0 | .32 | .32 | | | |
| Colo, overwash, frequently flooded--- | 15 | 0-15 | 20-26 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 38 |
| | | 15-50 | 30-35 | 1.25-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 3.0-4.0 | .28 | .28 | | | |
| | | 50-70 | 27-35 | 1.35-1.45 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 1.0-2.0 | .32 | .32 | | | |
| | | 70-80 | 27-35 | 1.35-1.45 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .32 | .32 | | | |

Physical Properties of the Soils--Continued

| Map symbol and soil name | Pct. of map unit | Depth | Clay | Moist bulk density | Permea-bility | Available water capacity | Linear extensi-bility | Organic matter | Erosion factors Kw | Kf | T | Wind erodi-bility group | Wind erodi-bility index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | In | Pct | g/cc | In/hr | In/in | Pct | Pct | | | | | |
| 509: | | | | | | | | | | | | | |
| Marshall, bench------- | 75 | 0-7 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 0.0-2.9 | 3.0-4.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-22 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 0.0-2.9 | 2.0-3.0 | .28 | .28 | | | |
| | | 22-65 | 27-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| | | 65-80 | 22-30 | 1.30-1.40 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |
| 509B: | | | | | | | | | | | | | |
| Marshall, bench------- | 90 | 0-7 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 0.0-2.9 | 3.0-4.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-22 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 0.0-2.9 | 2.0-3.0 | .28 | .28 | | | |
| | | 22-65 | 27-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| | | 65-80 | 22-30 | 1.30-1.40 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |
| 509C: | | | | | | | | | | | | | |
| Marshall, bench------- | 85 | 0-7 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 0.0-2.9 | 3.0-4.0 | .28 | .28 | 5 | 6 | 48 |
| | | 7-22 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 0.0-2.9 | 2.0-3.0 | .28 | .28 | | | |
| | | 22-65 | 27-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| | | 65-80 | 22-30 | 1.30-1.40 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 0.0-0.5 | .43 | .43 | | | |
| 509D2: | | | | | | | | | | | | | |
| Marshall, bench, | | | | | | | | | | | | | |
| moderately eroded---- | 65 | 0-7 | 27-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 2.0-3.0 | .32 | .32 | 5 | 6 | 48 |
| | | 7-47 | 27-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 1.0-2.0 | .32 | .32 | | | |
| | | 47-80 | 23-34 | 1.30-1.35 | 0.6-2 | 0.18-0.20 | 3.0-5.9 | 0.0-1.0 | .43 | .43 | | | |
| 630: | | | | | | | | | | | | | |
| Danbury, occasionally | | | | | | | | | | | | | |
| flooded------------- | 80 | 0-7 | 20-30 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 2.0-4.0 | .32 | .32 | 5 | 6 | 48 |
| | | 7-32 | 18-35 | 1.25-1.30 | 0.6-2 | 0.21-0.23 | 3.0-5.9 | 1.0-2.5 | .32 | .32 | | | |
| | | 32-64 | 26-40 | 1.30-1.40 | 0.6-2 | 0.18-0.20 | 6.0-8.9 | 3.0-4.0 | .32 | .32 | | | |
| | | 64-80 | 26-40 | 1.30-1.40 | 0.6-2 | 0.18-0.20 | 6.0-8.9 | 2.0-3.0 | .32 | .32 | | | |
| 700B: | | | | | | | | | | | | | |
| Monona, bench--------- | 75 | 0-15 | 26-35 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 3.0-4.0 | .28 | .28 | 5 | 6 | 38 |
| | | 15-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 700C2: | | | | | | | | | | | | | |
| Monona, bench, | | | | | | | | | | | | | |
| moderately eroded---- | 50 | 0-7 | 26-35 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 38 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |

Physical Properties of the Soils--Continued

| Map symbol and soil name | Pct. of map unit | Depth | Clay | Moist bulk density | Permea- bility | Available water capacity | Linear extensi- bility | Organic matter | Erosion factors | | | Wind erodi- bility group | Wind erodi- bility index |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | Kw | Kf | T | | |
| | | In | Pct | g/cc | In/hr | In/in | Pct | Pct | | | | | |
| 700D2: | | | | | | | | | | | | | |
| Monona, bench, moderately eroded---- | 60 | 0-7 | 26-35 | 1.25-1.30 | 0.6-2 | 0.22-0.24 | 3.0-5.9 | 2.0-3.0 | .28 | .28 | 5 | 6 | 38 |
| | | 7-30 | 24-27 | 1.30-1.35 | 0.6-2 | 0.20-0.22 | 3.0-5.9 | 1.0-1.0 | .43 | .43 | | | |
| | | 30-60 | 18-24 | 1.35-1.40 | 0.6-2 | 0.20-0.22 | 0.0-2.9 | 0.0-0.5 | .43 | .43 | | | |
| 5010: | | | | | | | | | | | | | |
| Pits, sand and gravel | 100 | --- | --- | --- | --- | --- | --- | --- | --- | --- | - | --- | --- |
| 5040: | | | | | | | | | | | | | |
| Udorthents, loamy----- | 100 | --- | --- | --- | --- | --- | --- | --- | --- | --- | - | --- | --- |
| 5080: | | | | | | | | | | | | | |
| Udorthents, sanitary landfill------------- | 100 | --- | --- | --- | --- | --- | --- | --- | --- | --- | - | --- | --- |
| AW: | | | | | | | | | | | | | |
| Animal waste lagoon--- | 100 | --- | --- | --- | --- | --- | --- | --- | --- | --- | - | --- | --- |
| SL: | | | | | | | | | | | | | |
| Sewage lagoon--------- | 100 | --- | --- | --- | --- | --- | --- | --- | --- | --- | - | --- | --- |
| W: | | | | | | | | | | | | | |
| Water----------------- | 100 | --- | --- | --- | --- | --- | --- | --- | --- | --- | - | --- | --- |

## Chemical Properties

The table described in this section shows estimates of some chemical characteristics and features that affect soil behavior. These estimates are given for the layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

*Depth* to the upper and lower boundaries of each layer is indicated.

*Cation-exchange capacity* is the total amount of extractable bases that can be held by the soil, expressed in terms of milliequivalents per 100 grams of soil at neutrality (pH 7.0) or at some other stated pH value. Soils having a low cation-exchange capacity hold fewer cations and may require more frequent applications of fertilizer than soils having a high cation-exchange capacity. The ability to retain cations reduces the hazard of ground-water pollution.

*Effective cation-exchange capacity* refers to the sum of extractable bases plus aluminum expressed in terms of milliequivalents per 100 grams of soil. It is determined for soils that have pH of less than 5.5.

*Soil reaction* is a measure of acidity or alkalinity. The pH of each soil horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

*Calcium carbonate* equivalent is the percent of carbonates, by weight, in the fraction of the soil less than 2 millimeters in size. The availability of plant nutrients is influenced by the amount of carbonates in the soil. Incorporating nitrogen fertilizer into calcareous soils helps to prevent nitrite accumulation and ammonium-N volatilization.

Chemical Properties of the Soils

(Absence of an entry indicates that data were not estimated)

| Map symbol and soil name | Depth | Cation-exchange capacity | Soil reaction | Calcium carbon-ate |
|---|---|---|---|---|
| | In | meq/100 g | pH | Pct |
| 1C3: | | | | |
| Ida, severely eroded | 0-3 | 20-25 | 6.6-8.4 | 0-25 |
| | 3-80 | 20-25 | 7.4-8.4 | 5-30 |
| 1D3: | | | | |
| Ida, severely eroded | 0-3 | 20-25 | 6.6-8.4 | 0-25 |
| | 3-80 | 20-25 | 7.4-8.4 | 5-30 |
| 1E3: | | | | |
| Ida, severely eroded | 0-3 | 20-25 | 6.6-8.4 | 0-25 |
| | 3-80 | 20-25 | 7.4-8.4 | 5-30 |
| 1F3: | | | | |
| Ida, severely eroded | 0-3 | 20-25 | 6.6-8.4 | 0-25 |
| | 3-80 | 20-25 | 7.4-8.4 | 5-30 |
| 8B: | | | | |
| Judson--------------- | 0-9 | 25-30 | 5.6-7.3 | 0 |
| | 9-28 | 25-30 | 5.6-7.3 | 0 |
| | 28-52 | 25-30 | 6.1-7.8 | 0-15 |
| | 52-60 | 25-30 | 6.1-7.8 | 0-15 |
| 8C: | | | | |
| Judson--------------- | 0-9 | 25-30 | 5.6-7.3 | 0 |
| | 9-28 | 25-30 | 5.6-7.3 | 0 |
| | 28-52 | 25-30 | 6.1-7.8 | 0-15 |
| | 52-60 | 25-30 | 6.1-7.8 | 0-15 |
| 9: | | | | |
| Marshall------------- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-22 | 25-30 | 5.6-7.3 | 0 |
| | 22-65 | 25-30 | 5.6-7.3 | 0 |
| | 65-80 | 20-25 | 6.6-7.3 | 0 |
| 9B: | | | | |
| Marshall------------- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-22 | 25-30 | 5.6-7.3 | 0 |
| | 22-65 | 25-30 | 5.6-7.3 | 0 |
| | 65-80 | 20-25 | 6.6-7.3 | 0 |
| 9C2: | | | | |
| Marshall, moderately eroded------------- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-47 | 25-30 | 5.6-7.3 | 0 |
| | 47-80 | 25-30 | 5.6-7.3 | 0 |
| 9D2: | | | | |
| Marshall, moderately eroded------------- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-47 | 25-30 | 5.6-7.3 | 0 |
| | 47-80 | 25-30 | 5.6-7.3 | 0 |
| 10C2: | | | | |
| Monona, moderately eroded------------- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |

Chemical Properties of the Soils--Continued

| Map symbol and soil name | Depth | Cation-exchange capacity | Soil reaction | Calcium carbon-ate |
|---|---|---|---|---|
| | In | meq/100 g | pH | Pct |
| 10D2: | | | | |
| Monona, moderately eroded | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 10E2: | | | | |
| Monona, moderately eroded | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 10F2: | | | | |
| Monona, moderately eroded | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 12B: | | | | |
| Napier | 0-8 | 20-25 | 6.1-7.3 | 0 |
| | 8-29 | 20-25 | 6.1-7.3 | 0 |
| | 29-48 | 20-25 | 6.1-8.4 | 0-10 |
| | 48-60 | 20-25 | 6.6-8.4 | 0-10 |
| 12C: | | | | |
| Napier | 0-8 | 20-25 | 6.1-7.3 | 0 |
| | 8-29 | 20-25 | 6.1-7.3 | 0 |
| | 29-48 | 20-25 | 6.1-8.4 | 0-10 |
| | 48-60 | 20-25 | 6.6-8.4 | 0-10 |
| 24E2: | | | | |
| Shelby, moderately eroded | 0-7 | 20-25 | 5.1-7.3 | 0 |
| | 7-33 | 20-25 | 5.1-7.3 | 0 |
| | 33-49 | 20-25 | 7.4-8.4 | 0-20 |
| | 49-80 | 20-25 | 7.4-8.4 | 0-20 |
| 24F2: | | | | |
| Shelby, moderately eroded | 0-7 | 20-25 | 5.1-7.3 | 0 |
| | 7-33 | 20-25 | 5.1-7.3 | 0 |
| | 33-49 | 20-25 | 7.4-8.4 | 0-20 |
| | 49-80 | 20-25 | 7.4-8.4 | 0-20 |
| 35D2: | | | | |
| Liston, moderately eroded | 0-5 | 25-30 | 7.4-8.4 | 0-15 |
| | 5-38 | 22-27 | 7.4-8.4 | 5-20 |
| | 38-80 | 20-31 | 7.4-8.4 | 5-20 |
| Burchard, moderately eroded | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-13 | 15-30 | 6.1-7.3 | 0 |
| | 13-52 | 15-25 | 7.4-8.4 | 5-25 |
| | 52-80 | 15-25 | 7.4-8.4 | 10-25 |

Chemical Properties of the Soils--Continued

| Map symbol and soil name | Depth | Cation-exchange capacity | Soil reaction | Calcium carbon-ate |
|---|---|---|---|---|
| | In | meq/100 g | pH | Pct |
| 54: | | | | |
| Zook, occasionally flooded | 0-6 | 36-41 | 5.6-7.8 | 0 |
| | 6-20 | 36-41 | 5.6-7.3 | 0 |
| | 20-52 | 36-41 | 6.1-7.3 | 0 |
| | 52-60 | 30-36 | 6.1-7.3 | 0 |
| 54+: | | | | |
| Zook, overwash, occasionally flooded | 0-9 | 20-25 | 5.6-7.3 | 0 |
| | 9-23 | 36-41 | 5.6-7.8 | 0 |
| | 23-64 | 36-41 | 6.1-7.3 | 0 |
| | 64-80 | 30-36 | 5.6-7.8 | 0 |
| 59E2: | | | | |
| Burchard, moderately eroded | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-13 | 15-30 | 6.1-7.3 | 0 |
| | 13-52 | 15-25 | 7.4-8.4 | 5-25 |
| | 52-80 | 15-25 | 7.4-8.4 | 10-25 |
| 59F2: | | | | |
| Burchard, moderately eroded | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-13 | 15-30 | 6.1-7.3 | 0 |
| | 13-52 | 15-25 | 7.4-8.4 | 5-25 |
| | 52-80 | 15-25 | 7.4-8.4 | 10-25 |
| 93D2: | | | | |
| Shelby, moderately eroded | 0-7 | 20-25 | 5.1-7.3 | 0 |
| | 7-33 | 20-25 | 5.1-7.3 | 0 |
| | 33-49 | 20-25 | 7.4-8.4 | 0-20 |
| | 49-80 | 20-25 | 7.4-8.4 | 0-20 |
| Adair, moderately eroded | 0-6 | 20-30 | 5.6-7.3 | 0 |
| | 6-18 | 41-50 | 5.1-6.5 | 0 |
| | 18-33 | 41-50 | 5.1-6.5 | 0 |
| | 33-56 | 41-50 | 5.1-6.5 | 0 |
| | 56-80 | 25-30 | 5.6-7.8 | 5-10 |
| 99D2: | | | | |
| Exira, moderately eroded | 0-6 | 28-34 | 5.6-6.5 | 0 |
| | 6-40 | 28-34 | 5.6-6.5 | 0 |
| | 40-80 | 28-34 | 6.1-7.3 | 0 |
| 99E2: | | | | |
| Exira, moderately eroded | 0-6 | 28-34 | 5.6-6.5 | 0 |
| | 6-40 | 28-34 | 5.6-6.5 | 0 |
| | 40-80 | 28-34 | 6.1-7.3 | 0 |
| 99F2: | | | | |
| Exira, moderately eroded | 0-6 | 28-34 | 5.6-6.5 | 0 |
| | 6-40 | 28-34 | 5.6-6.5 | 0 |
| | 40-80 | 28-34 | 6.1-7.3 | 0 |

Chemical Properties of the Soils--Continued

| Map symbol and soil name | Depth | Cation-exchange capacity | Soil reaction | Calcium carbon-ate |
|---|---|---|---|---|
| | In | meq/100 g | pH | Pct |
| 100B: | | | | |
| Monona--------------- | 0-15 | 25-30 | 5.6-7.3 | 0 |
| | 15-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 100C2: | | | | |
| Monona, moderately eroded------------- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 100D2: | | | | |
| Monona, moderately eroded------------- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 100D3: | | | | |
| Monona, severely eroded------------- | 0-3 | 25-30 | 5.6-7.3 | 0 |
| | 3-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 100E2: | | | | |
| Monona, moderately eroded------------- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 100F2: | | | | |
| Monona, moderately eroded------------- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 101F3: | | | | |
| Monona, moderately eroded------------- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| Ida, severely eroded | 0-3 | 20-25 | 6.6-8.4 | 0-25 |
| | 3-80 | 20-25 | 7.4-8.4 | 5-30 |
| 212: | | | | |
| Kennebec, occasionally flooded | 0-8 | 30-36 | 5.6-7.3 | 0 |
| | 8-54 | 30-36 | 6.1-7.3 | 0 |
| | 54-80 | 30-36 | 6.1-7.3 | 0 |
| 220: | | | | |
| Nodaway, occasionally flooded------------ | 0-7 | 20-25 | 6.1-7.3 | 0 |
| | 7-31 | 20-25 | 6.1-7.3 | 0 |
| | 31-42 | 20-25 | 6.1-7.3 | 0 |
| | 42-80 | 20-25 | 6.1-7.3 | 0 |
| 222D2: | | | | |
| Clarinda, moderately eroded------------- | 0-7 | 36-41 | 5.1-7.3 | 0 |
| | 7-80 | 41-50 | 5.6-8.4 | 0-15 |

Chemical Properties of the Soils--Continued

| Map symbol and soil name | Depth | Cation-exchange capacity | Soil reaction | Calcium carbon-ate |
|---|---|---|---|---|
| | In | meq/100 g | pH | Pct |
| 430: | | | | |
| Ackmore, occasionally flooded | 0-6 | 25-30 | 5.6-7.3 | 0 |
| | 6-25 | 25-30 | 5.6-7.3 | 0 |
| | 25-60 | 25-30 | 5.6-7.8 | 5-10 |
| 431B: | | | | |
| Judson | 0-9 | 25-30 | 5.6-7.3 | 0 |
| | 9-28 | 25-30 | 5.6-7.3 | 0 |
| | 28-52 | 25-30 | 6.1-7.8 | 0-15 |
| | 52-60 | 25-30 | 6.1-7.8 | 0-15 |
| Ackmore, rarely flooded | 0-6 | 25-30 | 5.6-7.3 | 0 |
| | 6-25 | 25-30 | 5.6-7.3 | 0 |
| | 25-60 | 25-30 | 5.6-7.8 | 5-10 |
| Colo, overwash, frequently flooded | 0-15 | 25-30 | 5.6-7.3 | 0 |
| | 15-50 | 36-41 | 5.6-7.3 | 0 |
| | 50-70 | 30-36 | 6.1-7.3 | 0 |
| | 70-80 | 30-36 | 6.1-7.3 | 0 |
| 509: | | | | |
| Marshall, bench | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-22 | 25-30 | 5.6-7.3 | 0 |
| | 22-65 | 25-30 | 5.6-7.3 | 0 |
| | 65-80 | 20-25 | 6.6-7.3 | 0 |
| 509B: | | | | |
| Marshall, bench | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-22 | 25-30 | 5.6-7.3 | 0 |
| | 22-65 | 25-30 | 5.6-7.3 | 0 |
| | 65-80 | 20-25 | 6.6-7.3 | 0 |
| 509C: | | | | |
| Marshall, bench | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-22 | 25-30 | 5.6-7.3 | 0 |
| | 22-65 | 25-30 | 5.6-7.3 | 0 |
| | 65-80 | 20-25 | 6.6-7.3 | 0 |
| 509D2: | | | | |
| Marshall, bench, moderately eroded | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-47 | 25-30 | 5.6-7.3 | 0 |
| | 47-80 | 25-30 | 5.6-7.3 | 0 |
| 630: | | | | |
| Danbury, occasionally flooded | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-32 | 25-30 | 5.6-7.3 | 0 |
| | 32-64 | 25-30 | 6.1-7.3 | 0 |
| | 64-80 | 25-30 | 5.6-7.3 | 0 |
| 700B: | | | | |
| Monona, bench | 0-15 | 25-30 | 5.6-7.3 | 0 |
| | 15-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |

Chemical Properties of the Soils--Continued

| Map symbol and soil name | Depth | Cation-exchange capacity | Soil reaction | Calcium carbon-ate |
|---|---|---|---|---|
| | In | meq/100 g | pH | Pct |
| 700C2: | | | | |
| Monona, bench, | | | | |
| moderately eroded--- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 700D2: | | | | |
| Monona, bench, | | | | |
| moderately eroded--- | 0-7 | 25-30 | 5.6-7.3 | 0 |
| | 7-30 | 25-30 | 6.1-7.3 | 0 |
| | 30-60 | 20-25 | 6.6-8.4 | 0-25 |
| 5010. | | | | |
| Pits, sand and gravel | | | | |
| 5040. | | | | |
| Udorthents, loamy | | | | |
| 5080. | | | | |
| Udorthents, sanitary landfill | | | | |
| AW. | | | | |
| Animal waste lagoon | | | | |
| SL. | | | | |
| Sewage lagoon | | | | |
| W. | | | | |
| Water | | | | |

## Water Features

The table described in this section gives estimates of various water features. The estimates are used in land use planning that involves engineering considerations.

*Hydrologic soil groups* are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas.

*Surface runoff* refers to the loss of water from an area by flow over the land surface. Surface runoff classes are based on slope, climate, and vegetative cover. It is assumed that the surface of the soil is bare and that the retention of surface water resulting from irregularities in the ground surface is minimal. The classes are *negligible, very low, low, medium, high,* and *very high*.

The *months* in the table indicate the portion of the year in which the feature is most likely to be a concern.

*Water table* refers to a saturated zone in the soil. The table indicates, by month, depth to the top (*upper limit*) and base (*lower limit*) of the saturated zone in most years. Estimates of the upper and lower limits are based mainly on observations of the water table at selected sites and on evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. A saturated zone that lasts for less than a month is not considered a water table.

*Ponding* is standing water in a closed depression. Unless a drainage system is installed, the water is removed only by percolation, transpiration, or evaporation. The table indicates *surface water depth* and the *duration* and *frequency* of ponding. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, rare, occasional, and frequent. *None* means that ponding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of ponding is nearly 0 percent to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of ponding is 5 to 50 percent in any year); and *frequent* that it occurs, on the average, more than once in 2 years (the chance of ponding is more than 50 percent in any year).

*Flooding* is the temporary inundation of an area caused by overflowing streams, by runoff from adjacent slopes, or by tides. Water standing for short periods after rainfall

or snowmelt is not considered flooding, and water standing in swamps and marshes is considered ponding rather than flooding.

*Duration* and *frequency* are estimated. Duration is expressed as *extremely brief* if 0.1 hour to 4 hours, *very brief* if 4 hours to 2 days, *brief* if 2 to 7 days, *long* if 7 to 30 days, and *very long* if more than 30 days. Frequency is expressed as none, very rare, rare, occasional, frequent, and very frequent. *None* means that flooding is not probable; *very rare* that it is very unlikely but possible under extremely unusual weather conditions (the chance of flooding is less than 1 percent in any year); *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is 1 to 5 percent in any year); *occasional* that it occurs infrequently under normal weather conditions (the chance of flooding is 5 to 50 percent in any year); *frequent* that it is likely to occur often under normal weather conditions (the chance of flooding is more than 50 percent in any year but is less than 50 percent in all months in any year); and *very frequent* that it is likely to occur very often under normal weather conditions (the chance of flooding is more than 50 percent in all months of any year).

The information is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

Water Features

(See text for definitions of terms used in this table. Estimates of the frequency of ponding and flooding apply to the whole year rather than to individual months. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 1C3: | | | | | | | | | | |
| Ida, severely eroded------ | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 1D3: | | | | | | | | | | |
| Ida, severely eroded------ | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 1E3: | | | | | | | | | | |
| Ida, severely eroded------ | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 1F3: | | | | | | | | | | |
| Ida, severely eroded------ | B | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 8B: | | | | | | | | | | |
| Judson-------------------- | B | Low | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 8C: | | | | | | | | | | |
| Judson------------------- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 9: | | | | | | | | | | |
| Marshall------------------ | B | Low | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 9B: | | | | | | | | | | |
| Marshall------------------ | B | Low | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro- logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 9C2: | | | | | | | | | | |
| Marshall, moderately eroded------------------- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 9D2: | | | | | | | | | | |
| Marshall, moderately eroded------------------- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 10C2: | | | | | | | | | | |
| Monona, moderately eroded | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 10D2: | | | | | | | | | | |
| Monona, moderately eroded | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 10E2: | | | | | | | | | | |
| Monona, moderately eroded | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 10F2: | | | | | | | | | | |
| Monona, moderately eroded | B | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 12B: | | | | | | | | | | |
| Napier-------------------- | B | Low | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 12C: | | | | | | | | | | |
| Napier-------------------- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 24E2: | | | | | | | | | | |
| Shelby, moderately eroded | C | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro- logic group | Surface runoff | Month | Water table | | Ponding | | | Flooding | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Upper limit | Lower limit | Surface water depth | Duration | Frequency | Duration | Frequency |
| | | | | Ft | Ft | Ft | | | | |
| 24F2: | | | | | | | | | | |
| Shelby, moderately eroded | D | Very high | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 35D2: | | | | | | | | | | |
| Liston, moderately eroded | C | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| Burchard, moderately eroded------------------- | C | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 54: | | | | | | | | | | |
| Zook, occasionally flooded | C/D | Low | | | | | | | | |
| | | | January | 2.0-3.5 | >6.0 | --- | --- | None | --- | None |
| | | | February | 1.5-3.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | March | 0.5-2.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | April | 0.0-1.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | May | 0.5-1.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | June | 1.0-2.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | July | 2.0-3.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | August | 2.5-3.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | September | 3.0-4.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | October | 2.5-3.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | November | 1.5-3.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | December | 2.0-3.5 | >6.0 | --- | --- | None | --- | None |
| 54+: | | | | | | | | | | |
| Zook, overwash, occasionally flooded----- | C/D | Low | | | | | | | | |
| | | | January | 2.0-3.5 | >6.0 | --- | --- | None | --- | None |
| | | | February | 1.5-3.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | March | 0.5-2.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | April | 0.0-1.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | May | 0.5-1.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | June | 1.0-2.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | July | 2.0-3.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | August | 2.5-3.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | September | 3.0-4.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | October | 2.5-3.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | November | 1.5-3.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | December | 2.0-3.5 | >6.0 | --- | --- | None | --- | None |
| 59E2: | | | | | | | | | | |
| Burchard, moderately eroded------------------- | C | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 59F2: | | | | | | | | | | |
| Burchard, moderately eroded | C | Very high | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 93D2: | | | | | | | | | | |
| Shelby, moderately eroded | C | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| Adair, moderately eroded | D | Very high | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | 1.5-2.0 | 2.5-2.5 | --- | --- | None | --- | None |
| | | | April | 1.5-2.0 | 2.5-2.5 | --- | --- | None | --- | None |
| | | | May | 1.5-2.0 | 2.5-2.5 | --- | --- | None | --- | None |
| | | | June | 2.0-2.5 | 2.5-2.5 | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | 1.0-1.5 | 2.5-2.5 | --- | --- | None | --- | None |
| | | | November | 1.5-2.0 | 2.5-2.5 | --- | --- | None | --- | None |
| | | | December | 1.5-2.0 | 2.5-2.5 | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 99D2: | | | | | | | | | | |
| Exira, moderately eroded-- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 99E2: | | | | | | | | | | |
| Exira, moderately eroded-- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 99F2: | | | | | | | | | | |
| Exira, moderately eroded-- | B | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 100B: | | | | | | | | | | |
| Monona-------------------- | B | Low | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 100C2: | | | | | | | | | | |
| Monona, moderately eroded | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 100D2: | | | | | | | | | | |
| Monona, moderately eroded | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table | | Ponding | | | Flooding | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Upper limit | Lower limit | Surface water depth | Duration | Frequency | Duration | Frequency |
| | | | | Ft | Ft | Ft | | | | |
| 100D3: | | | | | | | | | | |
| Monona, severely eroded--- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 100E2: | | | | | | | | | | |
| Monona, moderately eroded | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 100F2: | | | | | | | | | | |
| Monona, moderately eroded | B | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro- logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 101F3: | | | | | | | | | | |
| Monona, moderately eroded | B | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| Ida, severely eroded------ | B | High | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 212: | | | | | | | | | | |
| Kennebec, occasionally flooded------------------ | B | Low | | | | | | | | |
| | | | January | 6.0-6.7 | >6.0 | --- | --- | None | --- | None |
| | | | February | 5.5-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | March | 4.5-6.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | April | 4.0-6.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | May | 4.5-6.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | June | 5.0-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | July | 6.0-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | August | 6.5-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | September | 6.5-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | October | 6.5-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | November | 5.5-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | December | 6.0-6.7 | >6.0 | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydrologic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 220: | | | | | | | | | | |
| Nodaway, occasionally flooded------------------ | B | Low | | | | | | | | |
| | | | January | 6.0-6.7 | >6.0 | --- | --- | None | --- | None |
| | | | February | 5.5-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | March | 4.5-6.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | April | 3.9-6.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | May | 4.5-6.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | June | 5.0-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | July | 6.0-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | August | 6.5-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | September | 6.5-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | October | 6.5-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | November | 5.5-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | December | 6.0-6.7 | >6.0 | --- | --- | None | --- | None |
| 222D2: | | | | | | | | | | |
| Clarinda, moderately eroded------------------- | D | Very high | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | 1.5-2.0 | 2.0-2.0 | --- | --- | None | --- | None |
| | | | March | 0.0-1.0 | 2.0-2.0 | --- | --- | None | --- | None |
| | | | April | 0.0-1.0 | 2.0-2.0 | --- | --- | None | --- | None |
| | | | May | 0.5-1.5 | 2.0-2.0 | --- | --- | None | --- | None |
| | | | June | 1.0-1.5 | 2.0-2.0 | --- | --- | None | --- | None |
| | | | July | 1.5-2.0 | 2.0-2.0 | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | 1.0-1.5 | 2.0-2.0 | --- | --- | None | --- | None |
| | | | November | 1.5-2.0 | 2.0-2.0 | --- | --- | None | --- | None |
| | | | December | 1.5-2.0 | 2.0-2.0 | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 430: | | | | | | | | | | |
| Ackmore, occasionally flooded------------------ | B | Low | | | | | | | | |
| | | | January | 3.0-5.5 | >6.0 | --- | --- | None | --- | None |
| | | | February | 2.5-5.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | March | 1.5-4.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | April | 1.0-3.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | May | 1.5-4.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | June | 2.0-4.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | July | 3.0-5.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | August | 3.5-6.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | September | 4.0-6.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | October | 3.5-6.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | November | 2.5-5.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | December | 3.0-5.5 | >6.0 | --- | --- | None | --- | None |
| 431B: | | | | | | | | | | |
| Judson-------------------- | B | Low | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| Ackmore, rarely flooded--- | B | Low | | | | | | | | |
| | | | January | 3.0-5.5 | >6.0 | --- | --- | None | --- | None |
| | | | February | 2.5-5.0 | >6.0 | --- | --- | None | Very brief | Rare |
| | | | March | 1.5-4.0 | >6.0 | --- | --- | None | Very brief | Rare |
| | | | April | 1.0-3.5 | >6.0 | --- | --- | None | Very brief | Rare |
| | | | May | 1.5-4.0 | >6.0 | --- | --- | None | Very brief | Rare |
| | | | June | 2.0-4.5 | >6.0 | --- | --- | None | Very brief | Rare |
| | | | July | 3.0-5.5 | >6.0 | --- | --- | None | Very brief | Rare |
| | | | August | 3.5-6.0 | >6.0 | --- | --- | None | Very brief | Rare |
| | | | September | 4.0-6.5 | >6.0 | --- | --- | None | Very brief | Rare |
| | | | October | 3.5-6.0 | >6.0 | --- | --- | None | Very brief | Rare |
| | | | November | 2.5-5.0 | >6.0 | --- | --- | None | Very brief | Rare |
| | | | December | 3.0-5.5 | >6.0 | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 431B: | | | | | | | | | | |
| Colo, overwash, frequently flooded------------------ | B | Low | | | | | | | | |
| | | | January | 2.0-3.5 | >6.0 | --- | --- | None | --- | None |
| | | | February | 1.5-3.0 | >6.0 | --- | --- | None | Very brief | Frequent |
| | | | March | 0.5-2.0 | >6.0 | --- | --- | None | Very brief | Frequent |
| | | | April | 0.0-1.0 | >6.0 | --- | --- | None | Very brief | Frequent |
| | | | May | 0.5-1.5 | >6.0 | --- | --- | None | Very brief | Frequent |
| | | | June | 1.0-2.0 | >6.0 | --- | --- | None | Very brief | Frequent |
| | | | July | 2.0-3.0 | >6.0 | --- | --- | None | Very brief | Frequent |
| | | | August | 2.5-3.5 | >6.0 | --- | --- | None | Very brief | Frequent |
| | | | September | 3.0-4.0 | >6.0 | --- | --- | None | Very brief | Frequent |
| | | | October | 2.5-3.5 | >6.0 | --- | --- | None | Very brief | Frequent |
| | | | November | 1.5-3.0 | >6.0 | --- | --- | None | Very brief | Frequent |
| | | | December | 2.0-3.5 | >6.0 | --- | --- | None | --- | None |
| 509: | | | | | | | | | | |
| Marshall, bench----------- | B | Low | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 509B: | | | | | | | | | | |
| Marshall, bench----------- | B | Low | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 509C: | | | | | | | | | | |
| Marshall, bench----------- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 509D2: | | | | | | | | | | |
| Marshall, bench, moderately eroded-------- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 630: | | | | | | | | | | |
| Danbury, occasionally flooded----------------- | B | Low | | | | | | | | |
| | | | January | 4.0-6.0 | >6.0 | --- | --- | None | --- | None |
| | | | February | 3.5-5.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | March | 2.5-4.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | April | 2.0-4.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | May | 2.5-4.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | June | 3.0-5.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | July | 4.0-6.0 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | August | 4.5-6.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | September | 5.0-6.7 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | October | 4.5-6.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | November | 3.5-5.5 | >6.0 | --- | --- | None | Brief | Occasional |
| | | | December | 4.0-6.0 | >6.0 | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table | | Ponding | | | Flooding | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Upper limit | Lower limit | Surface water depth | Duration | Frequency | Duration | Frequency |
| | | | | Ft | Ft | Ft | | | | |
| 700B: | | | | | | | | | | |
| Monona, bench------------- | B | Low | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 700C2: | | | | | | | | | | |
| Monona, bench, moderately eroded------------------- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |
| 700D2: | | | | | | | | | | |
| Monona, bench, moderately eroded------------------- | B | Medium | | | | | | | | |
| | | | January | --- | --- | --- | --- | None | --- | None |
| | | | February | --- | --- | --- | --- | None | --- | None |
| | | | March | --- | --- | --- | --- | None | --- | None |
| | | | April | --- | --- | --- | --- | None | --- | None |
| | | | May | --- | --- | --- | --- | None | --- | None |
| | | | June | --- | --- | --- | --- | None | --- | None |
| | | | July | --- | --- | --- | --- | None | --- | None |
| | | | August | --- | --- | --- | --- | None | --- | None |
| | | | September | --- | --- | --- | --- | None | --- | None |
| | | | October | --- | --- | --- | --- | None | --- | None |
| | | | November | --- | --- | --- | --- | None | --- | None |
| | | | December | --- | --- | --- | --- | None | --- | None |

Water Features--Continued

| Map symbol and soil name | Hydro-logic group | Surface runoff | Month | Water table: Upper limit | Water table: Lower limit | Ponding: Surface water depth | Ponding: Duration | Ponding: Frequency | Flooding: Duration | Flooding: Frequency |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | | Ft | Ft | Ft | | | | |
| 5010. Pits, sand and gravel | | | | | | | | | | |
| 5040. Udorthents, loamy | | | | | | | | | | |
| 5080. Udorthents, sanitary landfill | | | | | | | | | | |
| AW. Animal waste lagoon | | | | | | | | | | |
| SL. Sewage lagoon | | | | | | | | | | |
| W. Water | | | | | | | | | | |

## Soil Features

The table described in this section gives estimates of various soil features. The estimates are used in land use planning that involves engineering considerations.

*Potential for frost action* is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty and highly structured, clayey soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly, or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

*Risk of corrosion* pertains to potential soil-induced electrochemical or chemical action that corrodes or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel or concrete in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than the steel or concrete in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low, moderate,* or *high,* is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion also is expressed as *low, moderate,* or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Soil Features

(See text for definitions of terms used in this table. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

| Map symbol and soil name | Potential for frost action | Risk of corrosion: Uncoated steel | Risk of corrosion: Concrete |
|---|---|---|---|
| 1C3: | | | |
| Ida, severely eroded | High | Low | Low |
| 1D3: | | | |
| Ida, severely eroded | High | Low | Low |
| 1E3: | | | |
| Ida, severely eroded | High | Low | Low |
| 1F3: | | | |
| Ida, severely eroded | High | Low | Low |
| 8B: | | | |
| Judson | High | Moderate | Low |
| 8C: | | | |
| Judson | High | Moderate | Low |
| 9: | | | |
| Marshall | High | Moderate | Moderate |
| 9B: | | | |
| Marshall | High | Moderate | Moderate |
| 9C2: | | | |
| Marshall, moderately eroded | High | Moderate | Moderate |
| 9D2: | | | |
| Marshall, moderately eroded | High | Moderate | Moderate |
| 10C2: | | | |
| Monona, moderately eroded | High | Low | Low |
| 10D2: | | | |
| Monona, moderately eroded | High | Low | Low |
| 10E2: | | | |
| Monona, moderately eroded | High | Low | Low |
| 10F2: | | | |
| Monona, moderately eroded | High | Low | Low |
| 12B: | | | |
| Napier | High | Low | Low |
| 12C: | | | |
| Napier | High | Low | Low |
| 24E2: | | | |
| Shelby, moderately eroded | Moderate | Moderate | Moderate |

Soil Features--Continued

| Map symbol and soil name | Potential for frost action | Risk of corrosion | |
|---|---|---|---|
| | | Uncoated steel | Concrete |
| 24F2: | | | |
| Shelby, moderately eroded | Moderate | Moderate | Moderate |
| 35D2: | | | |
| Liston, moderately eroded | Moderate | High | Low |
| Burchard, moderately eroded | Moderate | Moderate | Low |
| 54: | | | |
| Zook, occasionally flooded | High | High | Moderate |
| 54+: | | | |
| Zook, overwash, occasionally flooded | High | High | Moderate |
| 59E2: | | | |
| Burchard, moderately eroded | Moderate | Moderate | Low |
| 59F2: | | | |
| Burchard, moderately eroded | Moderate | Moderate | Low |
| 93D2: | | | |
| Shelby, moderately eroded | Moderate | Moderate | Moderate |
| Adair, moderately eroded | High | High | Moderate |
| 99D2: | | | |
| Exira, moderately eroded | High | Moderate | Moderate |
| 99E2: | | | |
| Exira, moderately eroded | High | Moderate | Moderate |
| 99F2: | | | |
| Exira, moderately eroded | High | Moderate | Moderate |
| 100B: | | | |
| Monona | High | Low | Low |
| 100C2: | | | |
| Monona, moderately eroded | High | Low | Low |
| 100D2: | | | |
| Monona, moderately eroded | High | Low | Low |
| 100D3: | | | |
| Monona, severely eroded | High | Low | Low |
| 100E2: | | | |
| Monona, moderately eroded | High | Low | Low |

Soil Features--Continued

| Map symbol and soil name | Potential for frost action | Risk of corrosion | |
|---|---|---|---|
| | | Uncoated steel | Concrete |
| 100F2: | | | |
| Monona, moderately eroded | High | Low | Low |
| 101F3: | | | |
| Monona, moderately eroded | High | Low | Low |
| Ida, severely eroded | High | Low | Low |
| 212: | | | |
| Kennebec, occasionally flooded | High | Moderate | Low |
| 220: | | | |
| Nodaway, occasionally flooded | High | Moderate | Low |
| 222D2: | | | |
| Clarinda, moderately eroded | High | High | Moderate |
| 430: | | | |
| Ackmore, occasionally flooded | High | High | Low |
| 431B: | | | |
| Judson | High | Moderate | Low |
| Ackmore, rarely flooded | High | High | Low |
| Colo, overwash, frequently flooded | High | High | Moderate |
| 509: | | | |
| Marshall, bench | High | Moderate | Moderate |
| 509B: | | | |
| Marshall, bench | High | Moderate | Moderate |
| 509C: | | | |
| Marshall, bench | High | Moderate | Moderate |
| 509D2: | | | |
| Marshall, bench, moderately eroded | High | Moderate | Moderate |
| 630: | | | |
| Danbury, occasionally flooded | High | High | Low |
| 700B: | | | |
| Monona, bench | High | Low | Low |
| 700C2: | | | |
| Monona, bench, moderately eroded | High | Low | Low |
| 700D2: | | | |
| Monona, bench, moderately eroded | High | Low | Low |

Soil Features--Continued

| Map symbol and soil name | Potential for frost action | Risk of corrosion | |
|---|---|---|---|
| | | Uncoated steel | Concrete |
| 5010. | | | |
| Pits, sand and gravel | | | |
| 5040. | | | |
| Udorthents, loamy | | | |
| 5080. | | | |
| Udorthents, sanitary landfill | | | |
| AW. | | | |
| Animal waste lagoon | | | |
| SL. | | | |
| Sewage lagoon | | | |
| W. | | | |
| Water | | | |

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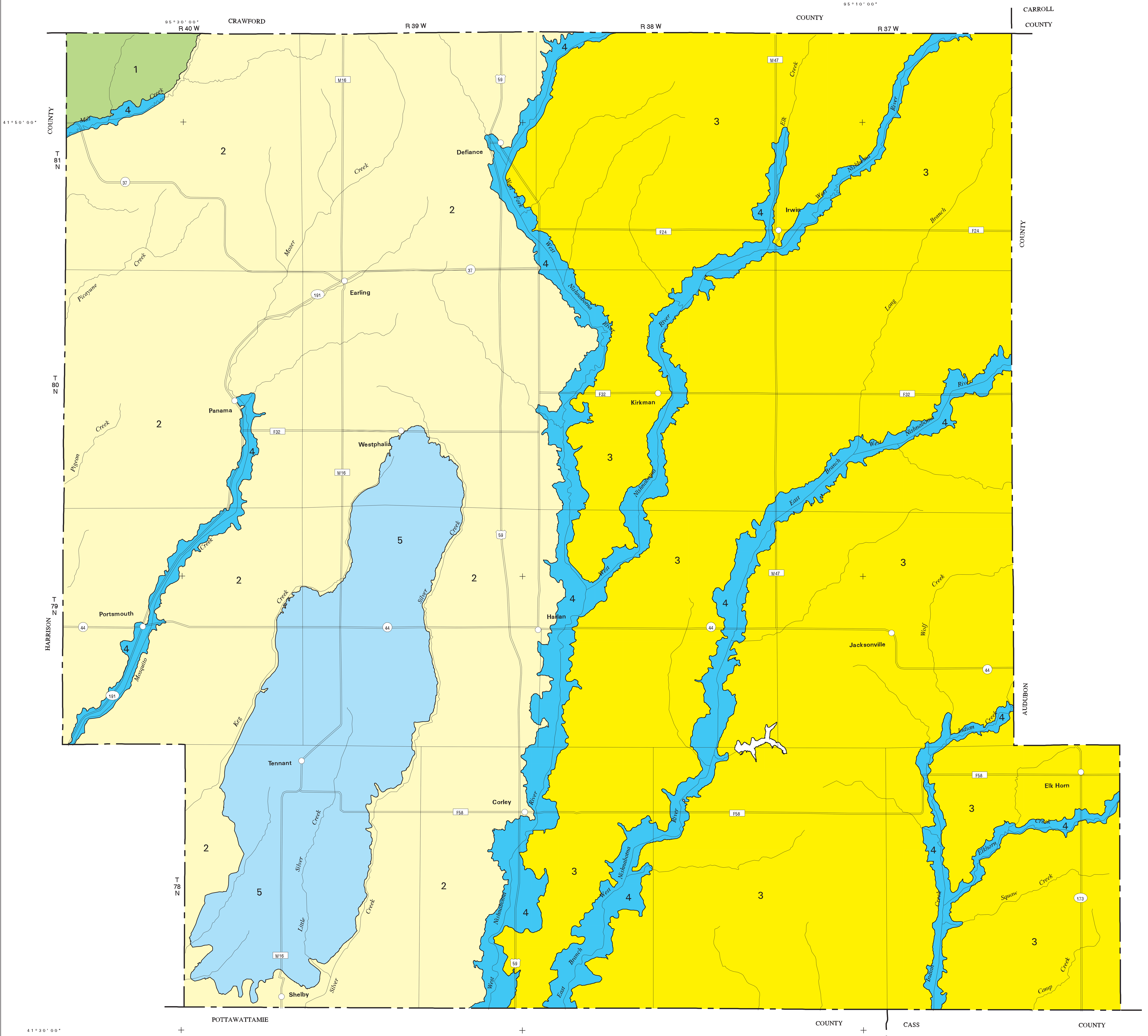



LEGEND

| | |
|---|---|
| 1 | Monona-Ida-Napier association |
| 2 | Monona-Judson-Ida association |
| 3 | Exira-Marshall-Judson association |
| 4 | Nodaway-Ackmore-Zook association |
| 5 | Monona-Marshall-Judson association |

UNITED STATES DEPARTMENT OF AGRICULTURE
NATURAL RESOURCES CONSERVATION SERVICE
IOWA AGRICULTURE AND HOME ECONOMICS EXPERIMENT STATION
COOPERATIVE EXTENSION SERVICE,
IOWA STATE UNIVERSITY
DIVISION OF SOIL CONSERVATION,
IOWA DEPARTMENT OF AGRICULTURE
AND LAND STEWARDSHIP

# GENERAL SOIL MAP
## SHELBY COUNTY, IOWA

1 0 1 2 3
MILES

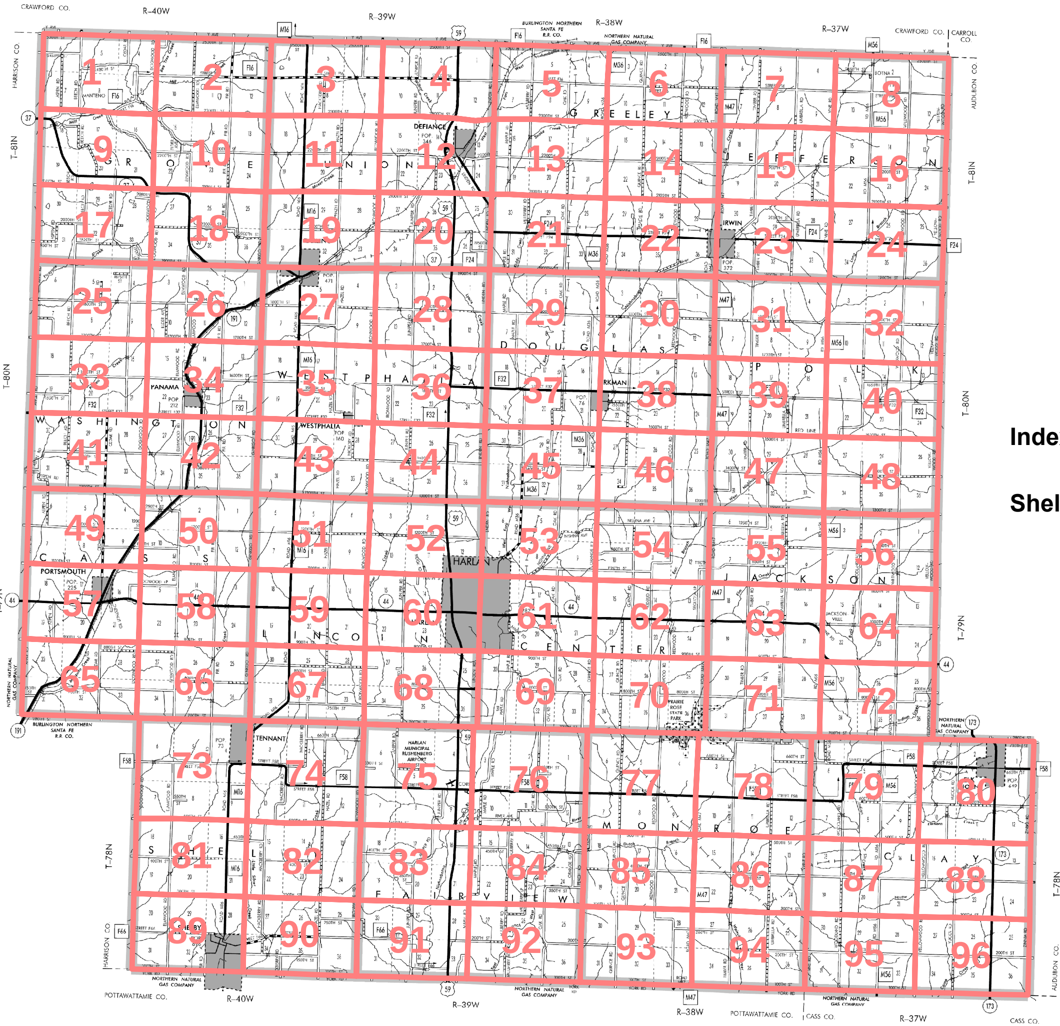
1 0 1 2 3 4 5 6
KILOMETERS

**SCALE = 1:95000**

**SECTIONALIZED TOWNSHIP**

| | | | | | |
|---|---|---|---|---|---|
| 6 | 5 | 4 | 3 | 2 | 1 |
| 7 | 8 | 9 | 10 | 11 | 12 |
| 18 | 17 | 16 | 15 | 14 | 13 |
| 19 | 20 | 21 | 22 | 23 | 24 |
| 30 | 29 | 28 | 27 | 26 | 25 |
| 31 | 32 | 33 | 34 | 35 | 36 |

*Each area outlined on this map consists of more than one kind of soil. The map is thus meant for general planning rather than a basis for decisions on the use of specific tracts.*




**Index to Map Sheets**

**Shelby County, Iowa**

# SHELBY COUNTY, IOWA

## SOIL LEGEND

Map unit symbols consist of a combination of numbers and letters. The initial numbers represent the kind of soil. A capital letter following those numbers indicates the class of slope. Map unit symbols that do not have a slope class letter are for nearly level soils or for miscellaneous areas. A final number of 2 following the slope class letter indicates that the map unit is predominantly moderately eroded. A final number of 3 indicates that the map unit is predominantly severely eroded. A plus sign (+) is used to designate an overwash phase.

| | |
|---|---|
| 1C3 | Ida silt loam, 5 to 9 percent slopes, severely eroded |
| 1D3 | Ida silt loam, 9 to 14 percent slopes, severely eroded |
| 1E3 | Ida silt loam, 14 to 20 percent slopes, severely eroded |
| 1F3 | Ida silt loam, 20 to 30 percent slopes, severely eroded |
| 8B | Judson silty clay loam, 2 to 5 percent slopes |
| 8C | Judson silty clay loam, 5 to 9 percent slopes |
| 9 | Marshall silty clay loam, 0 to 2 percent slopes |
| 9B | Marshall silty clay loam, 2 to 5 percent slopes |
| 9C2 | Marshall silty clay loam, 5 to 9 percent slopes, moderately eroded |
| 9D2 | Marshall silty clay loam, 9 to 14 percent slopes, moderately eroded |
| 10C2 | Monona silt loam, 5 to 9 percent slopes, moderately eroded |
| 10D2 | Monona silt loam, 9 to 14 percent slopes, moderately eroded |
| 10E2 | Monona silt loam, 14 to 20 percent slopes, moderately eroded |
| 10F2 | Monona silt loam, 20 to 30 percent slopes, moderately eroded |
| 12B | Napier silt loam, 2 to 5 percent slopes |
| 12C | Napier silt loam, 5 to 9 percent slopes |
| 24E2 | Shelby clay loam, 14 to 18 percent slopes, moderately eroded |
| 24F2 | Shelby clay loam, 18 to 25 percent slopes, moderately eroded |
| 35D2 | Liston-Burchard complex, 9 to 14 percent slopes, moderately eroded |
| 54 | Zook silty clay loam, 0 to 2 percent slopes, occasionally flooded |
| 54+ | Zook silt loam, 0 to 2 percent slopes, occasionally flooded, overwash |
| 59E2 | Burchard clay loam, 14 to 18 percent slopes, moderately eroded |
| 59F2 | Burchard clay loam, 18 to 25 percent slopes, moderately eroded |
| 93D2 | Shelby-Adair complex, 9 to 14 percent slopes, moderately eroded |
| 99D2 | Exira silty clay loam, 9 to 14 percent slopes, moderately eroded |
| 99E2 | Exira silty clay loam, 14 to 18 percent slopes, moderately eroded |
| 99F2 | Exira silty clay loam, 18 to 25 percent slopes, moderately eroded |
| 100B | Monona silty clay loam, 2 to 5 percent slopes |
| 100C2 | Monona silty clay loam, 5 to 9 percent slopes, moderately eroded |
| 100D2 | Monona silty clay loam, 9 to 14 percent slopes, moderately eroded |
| 100D3 | Monona silty clay loam, 9 to 14 percent slopes, severely eroded |
| 100E2 | Monona silty clay loam, 14 to 20 percent slopes, moderately eroded |
| 100F2 | Monona silty clay loam, 20 to 30 percent slopes, moderately eroded |
| 101F3 | Monona-Ida complex, 20 to 30 percent slopes, severely eroded |
| 212 | Kennebec silt loam, 0 to 2 percent slopes, occasionally flooded |
| 220 | Nodaway silt loam, 0 to 2 percent slopes, occasionally flooded |
| 222D2 | Clarinda silty clay loam, 9 to 14 percent slopes, moderately eroded |
| 430 | Ackmore silt loam, 0 to 2 percent slopes, occasionally flooded |
| 431B | Judson-Ackmore-Colo, overwash, complex, 1 to 5 percent slopes |
| 509 | Marshall silty clay loam, bench, 0 to 2 percent slopes |
| 509B | Marshall silty clay loam, bench, 2 to 5 percent slopes |
| 509C | Marshall silty clay loam, bench, 5 to 9 percent slopes |
| 509D2 | Marshall silty clay loam, bench, 9 to 14 percent slopes, moderately eroded |
| 630 | Danbury silt loam, 0 to 2 percent slopes, occasionally flooded |
| 700B | Monona silty clay loam, bench, 2 to 5 percent slopes |
| 700C2 | Monona silty clay loam, bench, 5 to 9 percent slopes, moderately eroded |
| 700D2 | Monona silty clay loam, bench, 9 to 14 percent slopes, moderately eroded |
| 5010 | Pits, sand and gravel |
| 5040 | Udorthents, loamy |
| 5080 | Udorthents, sanitary landfill |
| AW | Animal waste lagoon |
| SL | Sewage lagoon |
| W | Water |

## CONVENTIONAL AND SPECIAL SYMBOLS LEGEND

**SOIL SURVEY FEATURES**

SOIL DELINEATIONS AND LABELS

STANDARD LANDFORM AND MISCELLANEOUS SURFACE FEATURES

- Non-bedrock escarpment
- Gravel pit
- Gravelly spot
- Sandy spot
- Wet spot

AD HOC FEATURES

- Wet depression, restricted permeability
- Clay spot, red
- Calcareous spot
- Glacial till spot

BOUNDARIES

- County or parish
- Public Land Survey System Section Boundary
- Airport, airfield
- Cemetery
- County/State park

RAILROAD

DAMS

- Medium or Small

**HYDROGRAPHIC FEATURES**

DRAINAGE

- Perennial stream

INTERMITTENT

- Crossable with usual farm equipment
- Not crossable with usual farm equipment
- Drainage end (indicates direction of flow)

# Township 81N Range 40W

1

1

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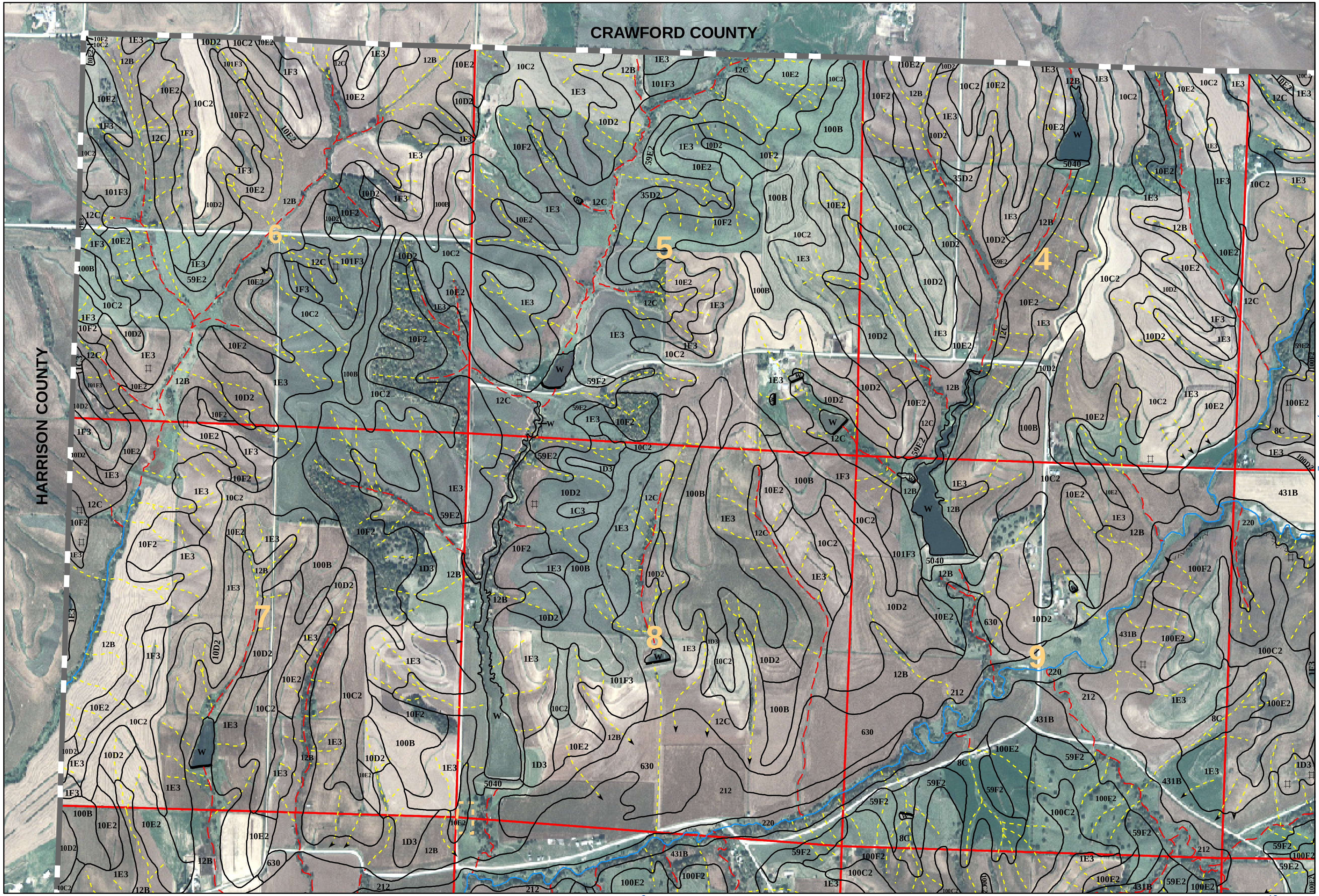


0 1/4 1/2 3/4 1 Miles

Feet 0 1,000 2,000 3,000 4,000 5,000

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0 1/4 1/2 3/4 1 Miles

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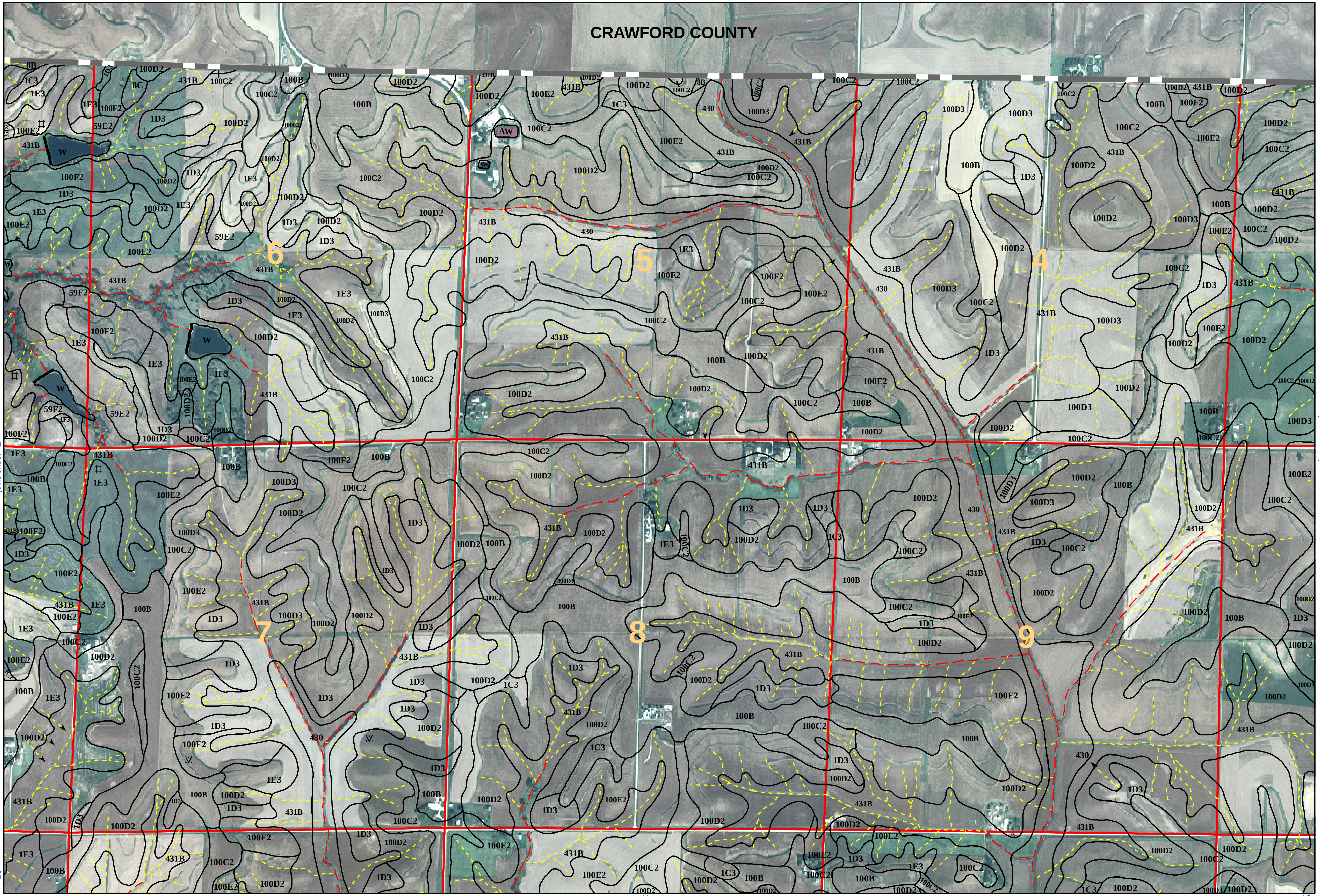
# Township 81N Range 39W

3

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# Township 81N Range 39W

4

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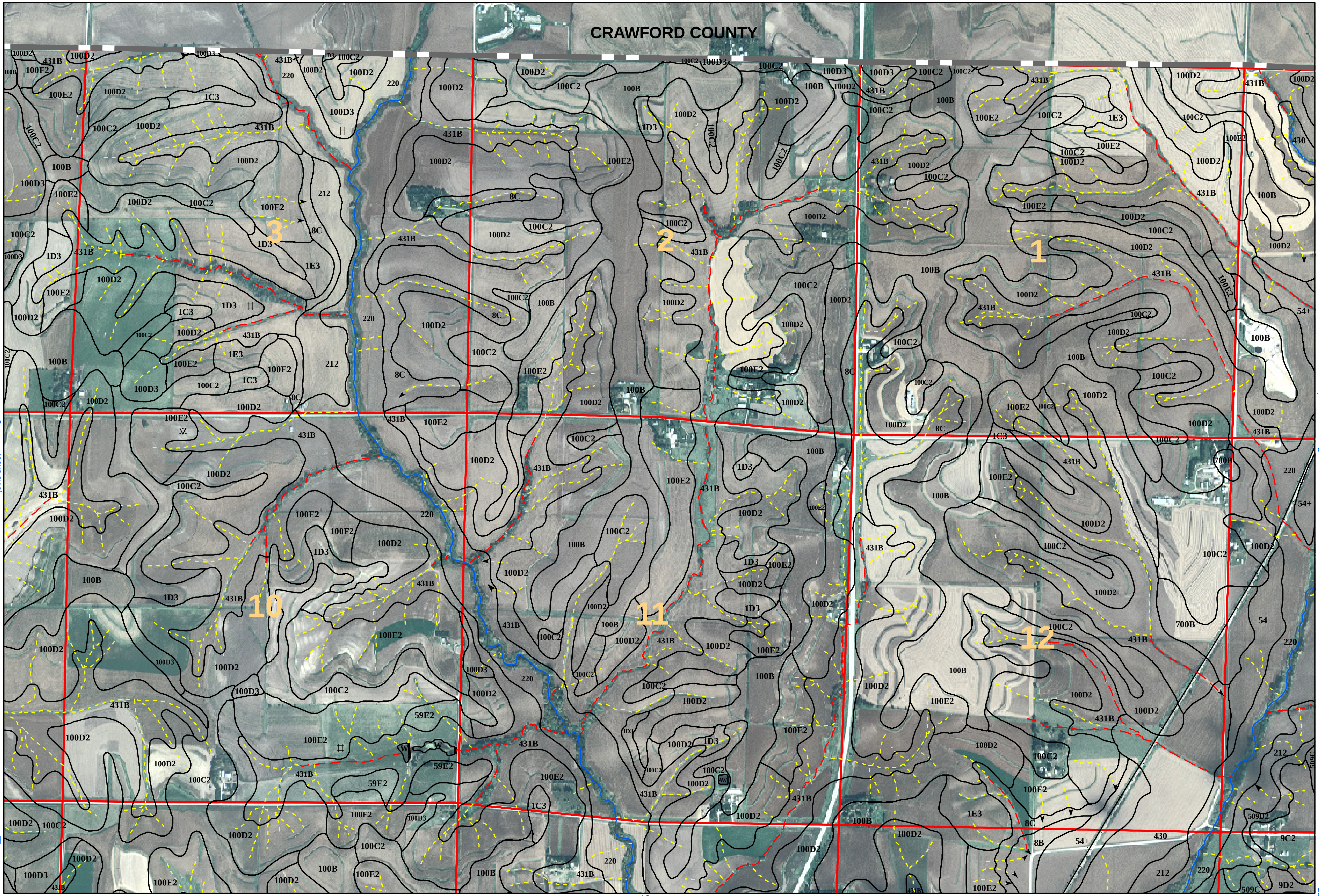


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# Township 81N Range 38W

5

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# Township 81N Range 38W

6

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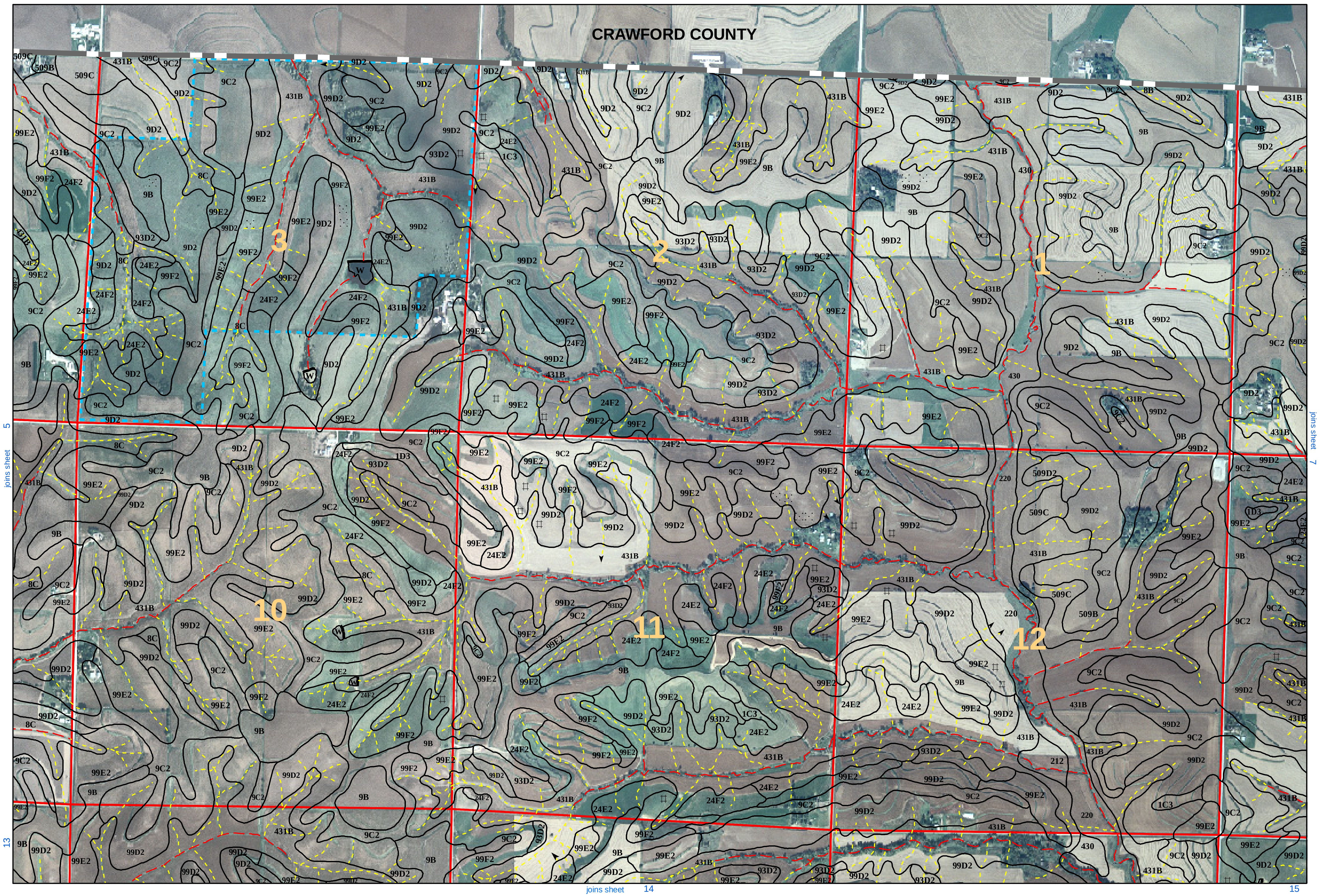


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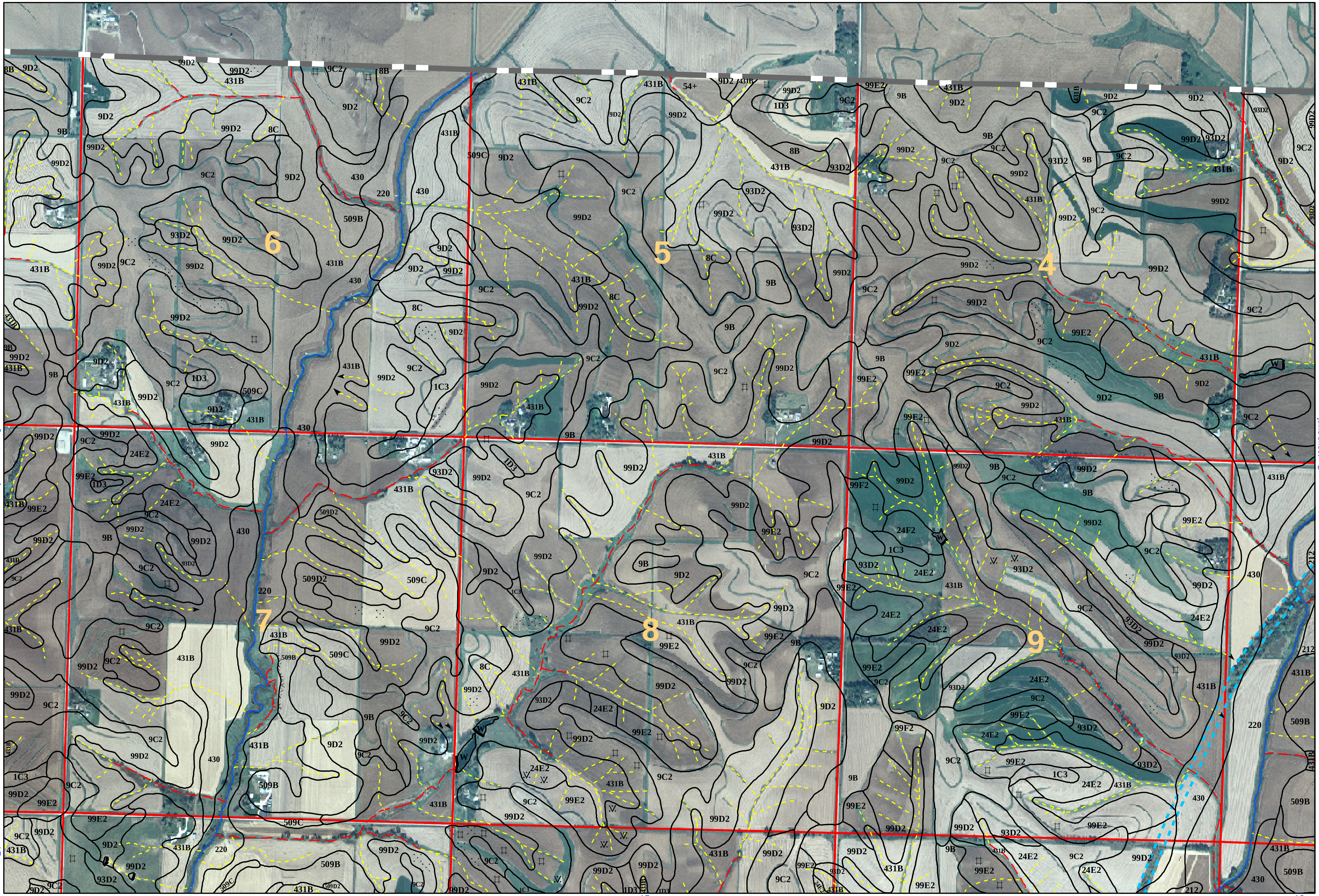


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8

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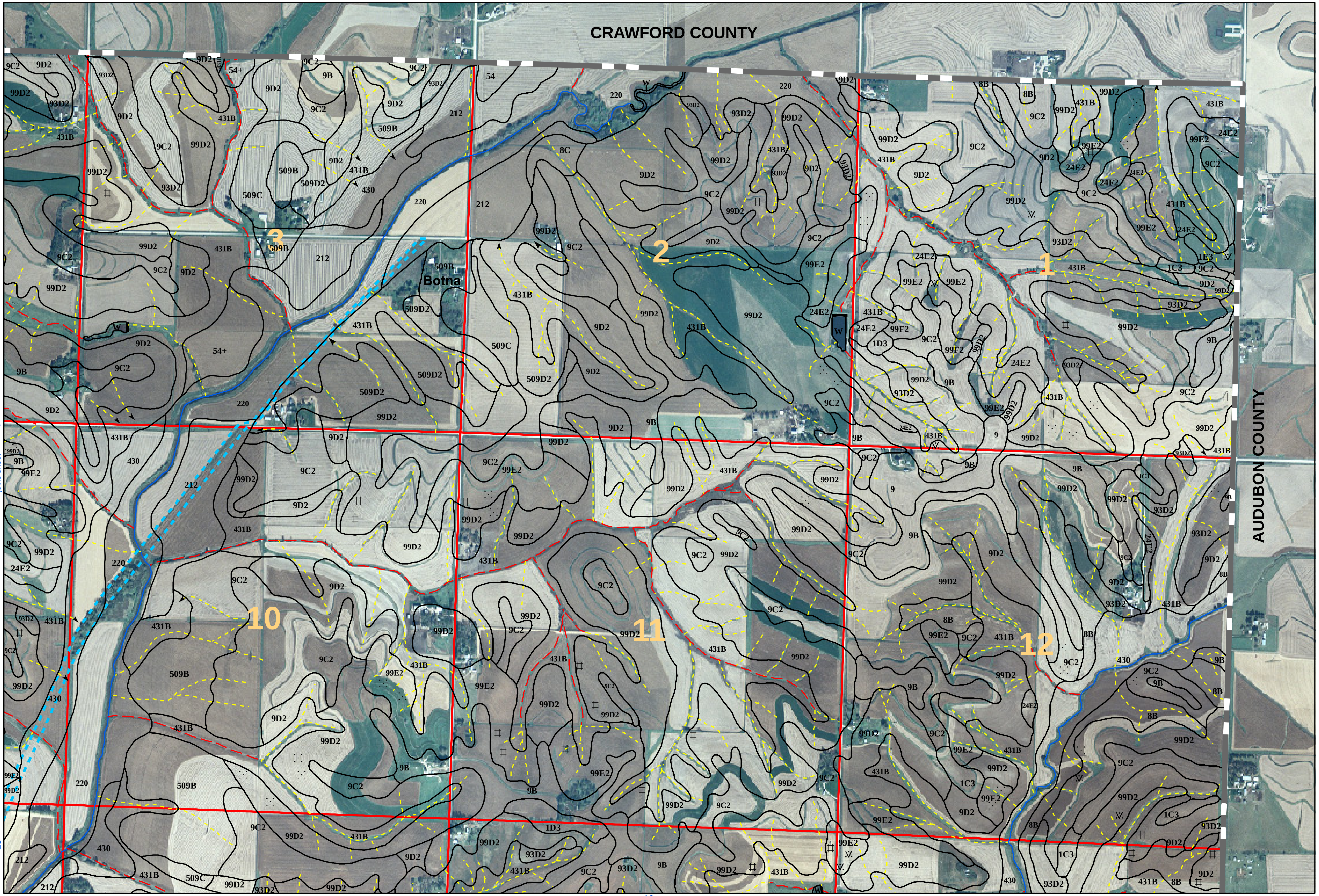


0 | 1/4 | 1/2 | 3/4 | 1 Miles

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# Township 81N Range 40W



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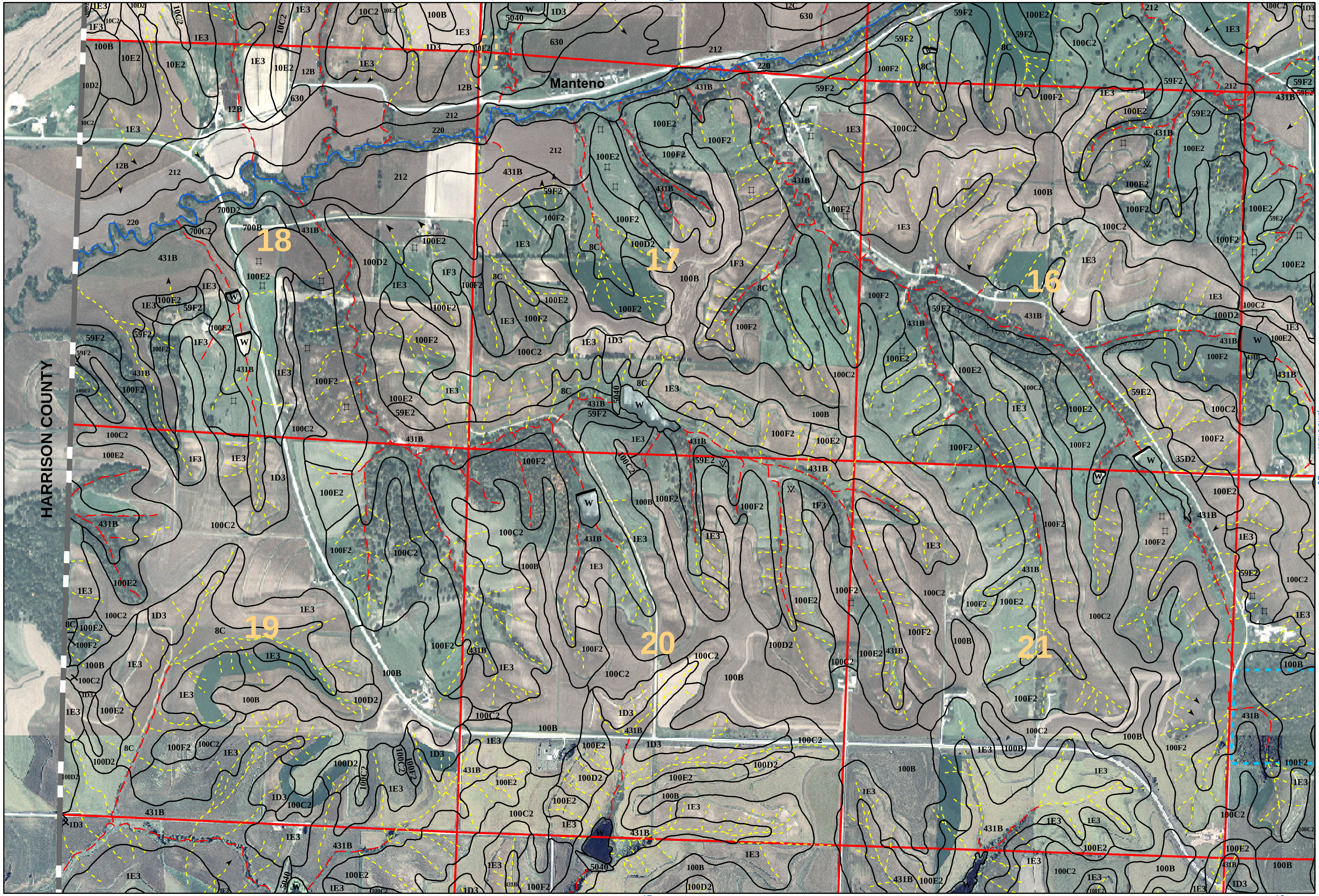


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joins sheet 17
18

0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 81N Range 40W

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# Township 81N Range 39W

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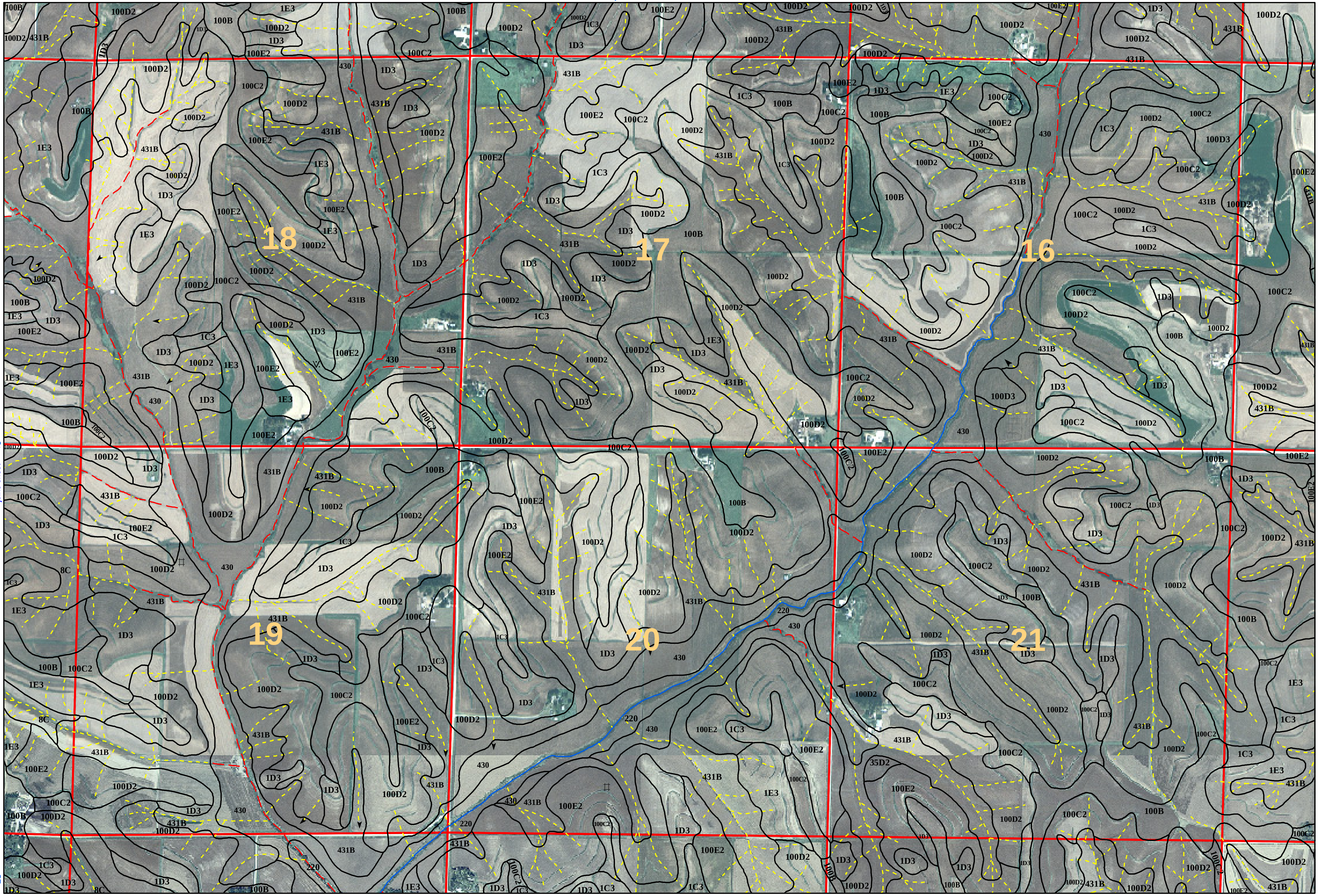


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0 1/4 1/2 3/4 1 Miles

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# Township 81N Range 39W

12

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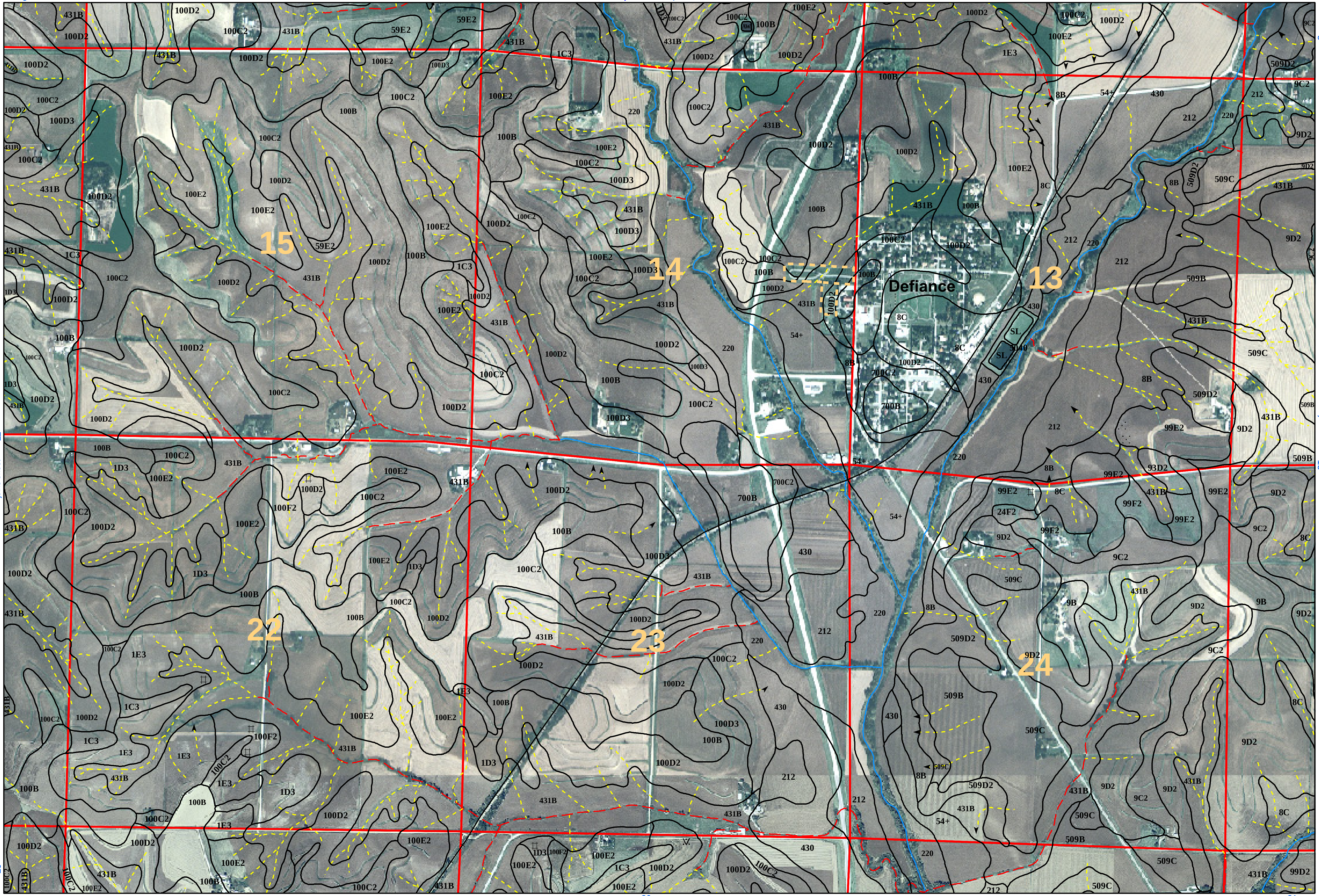


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 81N Range 38W

13

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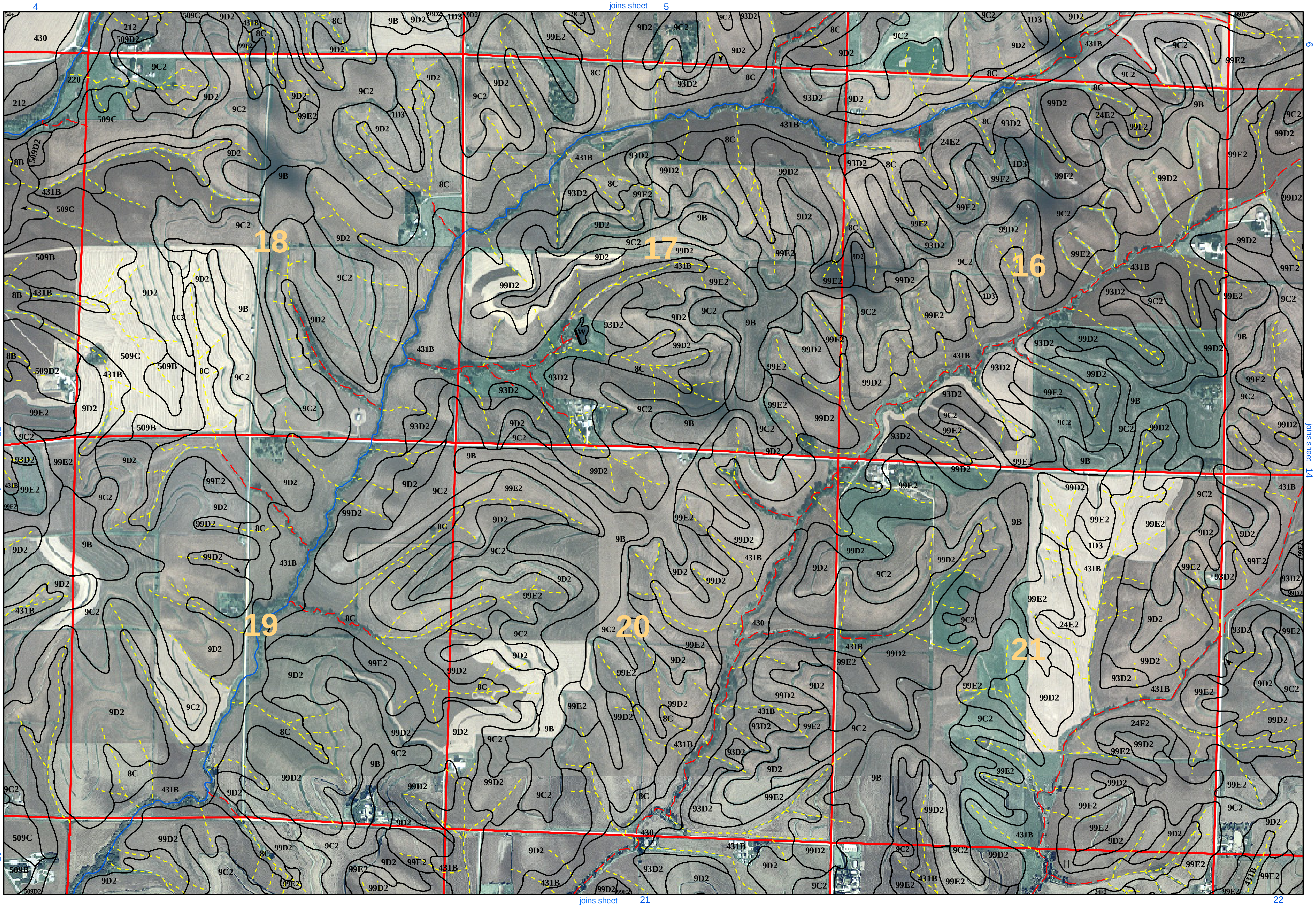


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# Township 81N Range 38W

14

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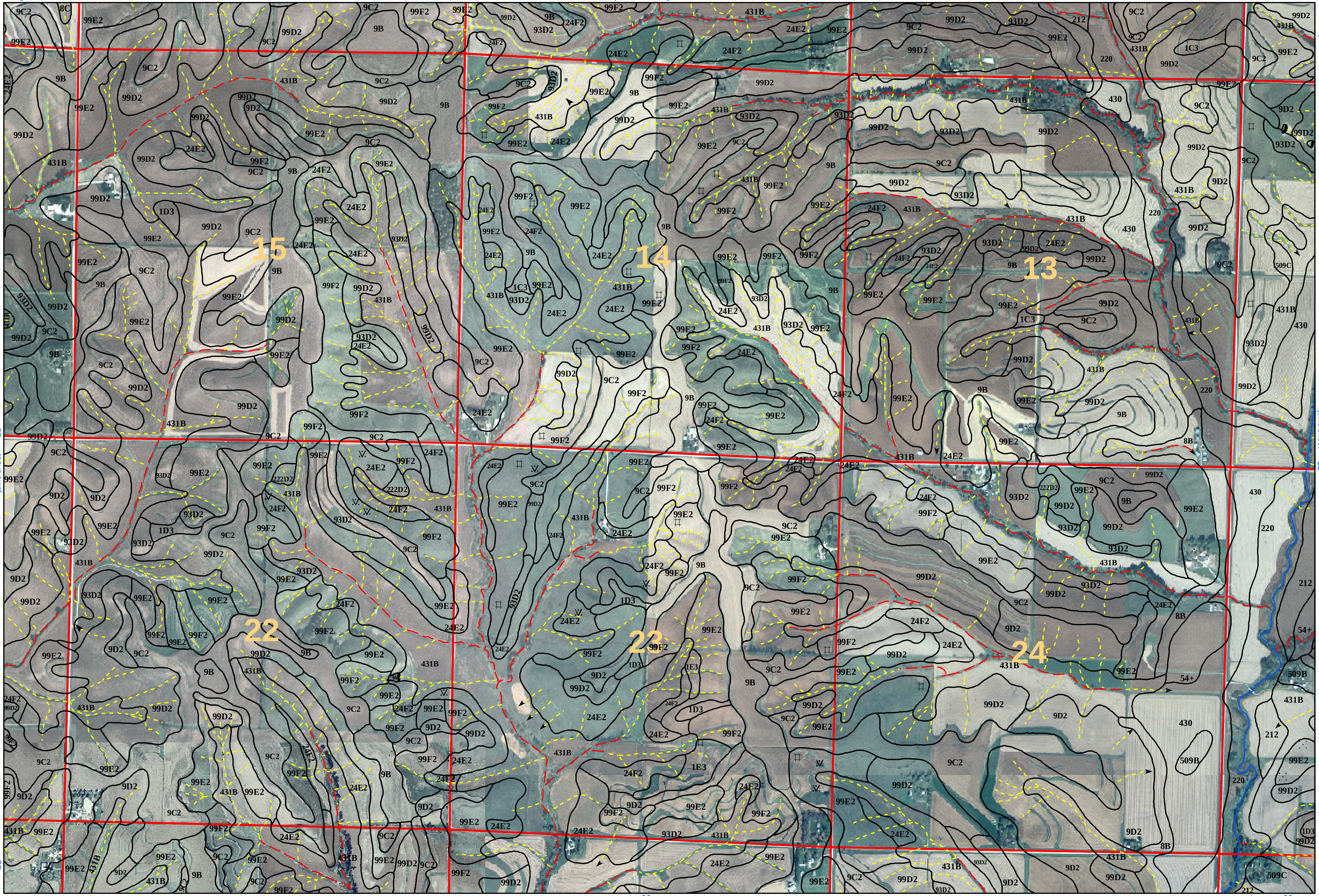


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# Township 81N Range 37W

15

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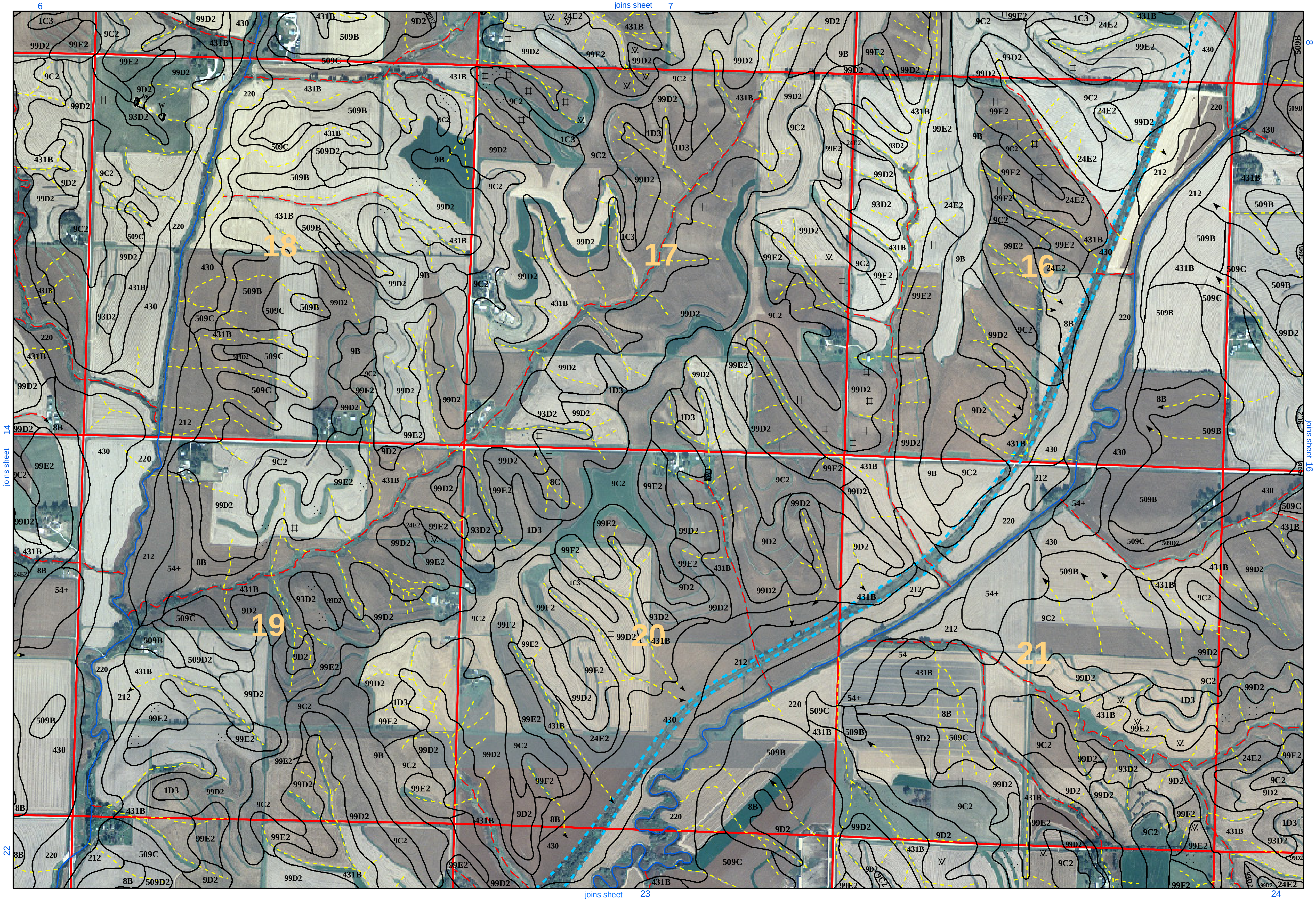


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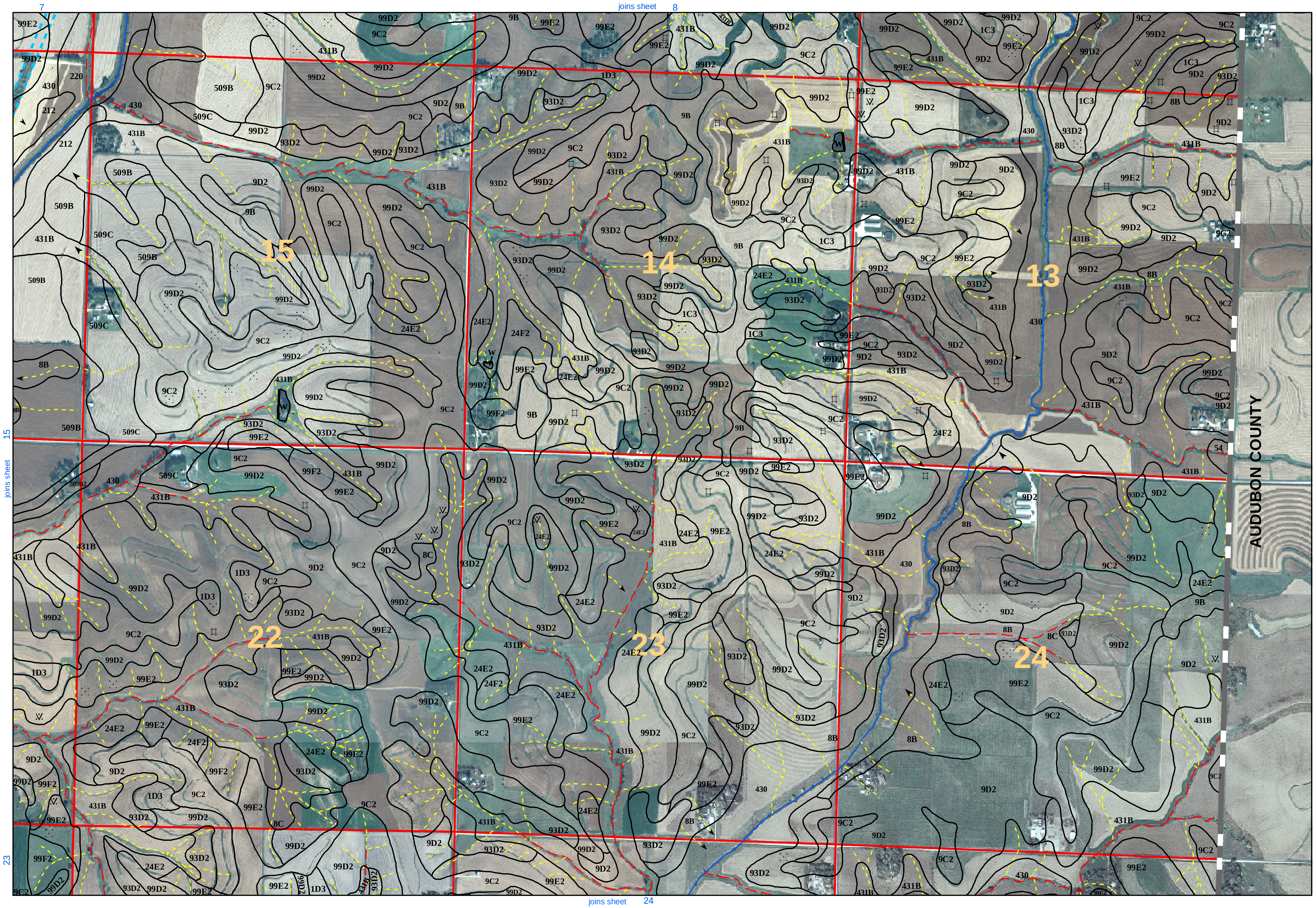
16

# Township 81N Range 37W

16

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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 81N Range 40W



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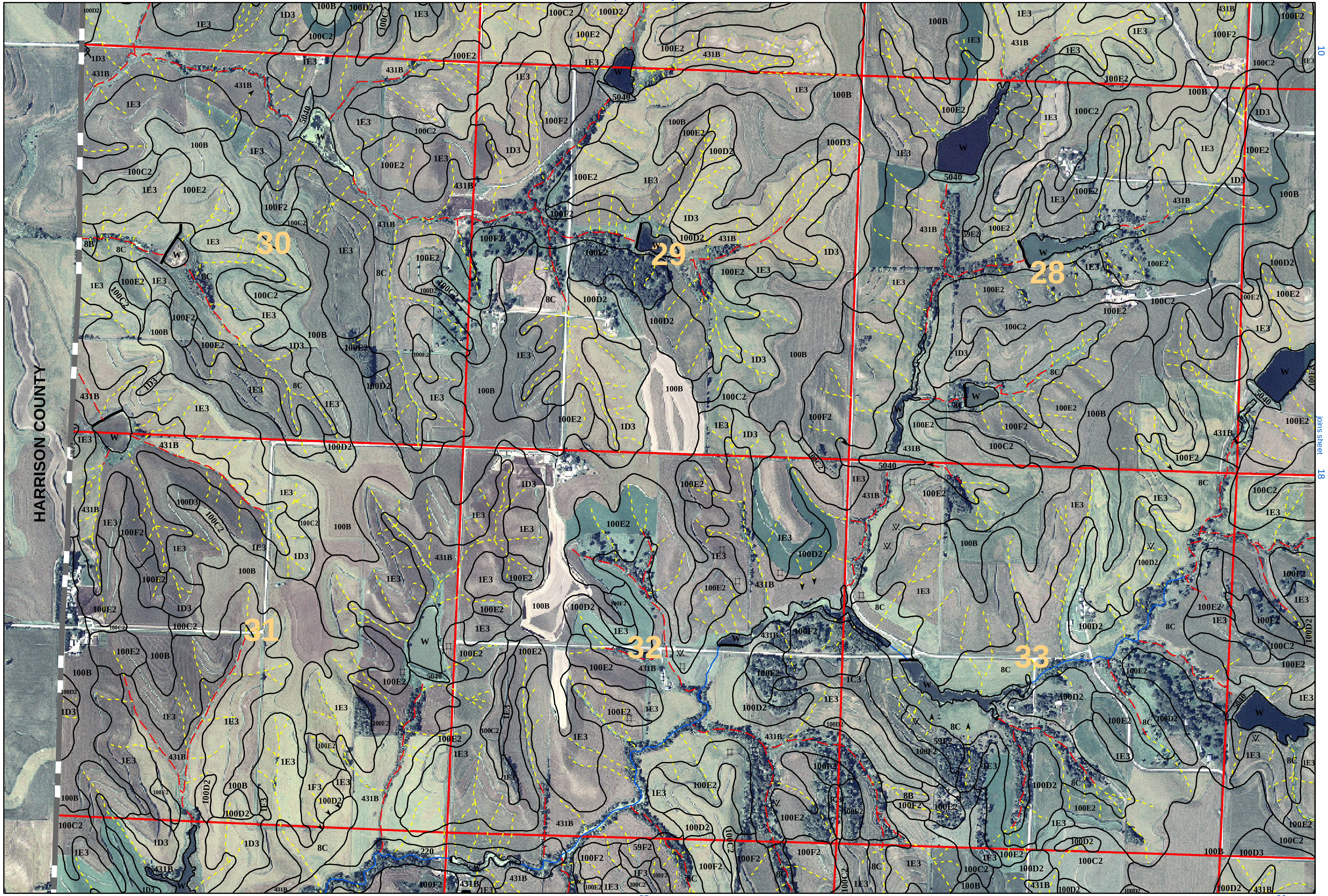


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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

United States Department of Agriculture
NRCS Natural Resources Conservation Service

18

# Township 81N Range 40W

18

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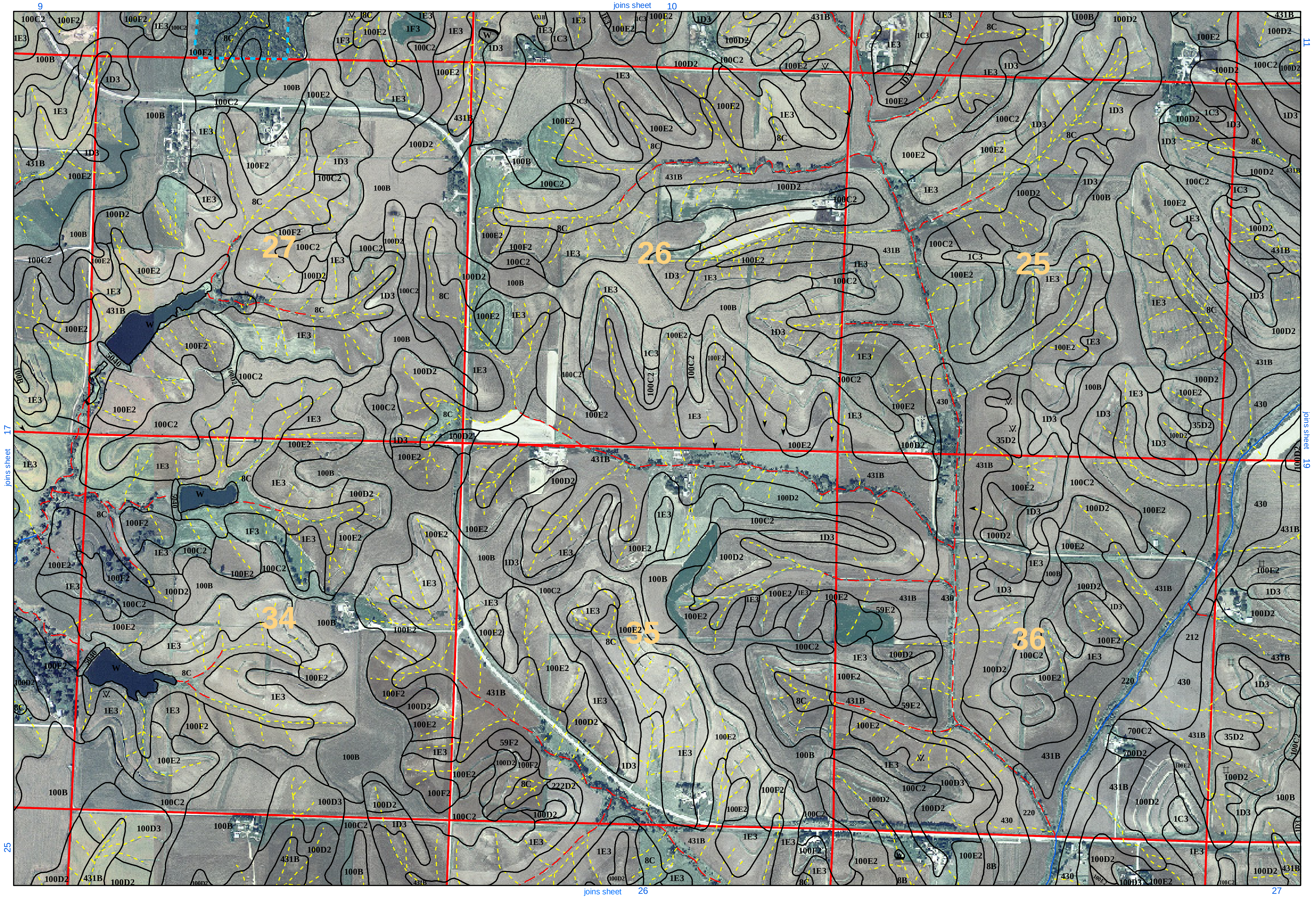


0 1/4 1/2 3/4 1 Miles

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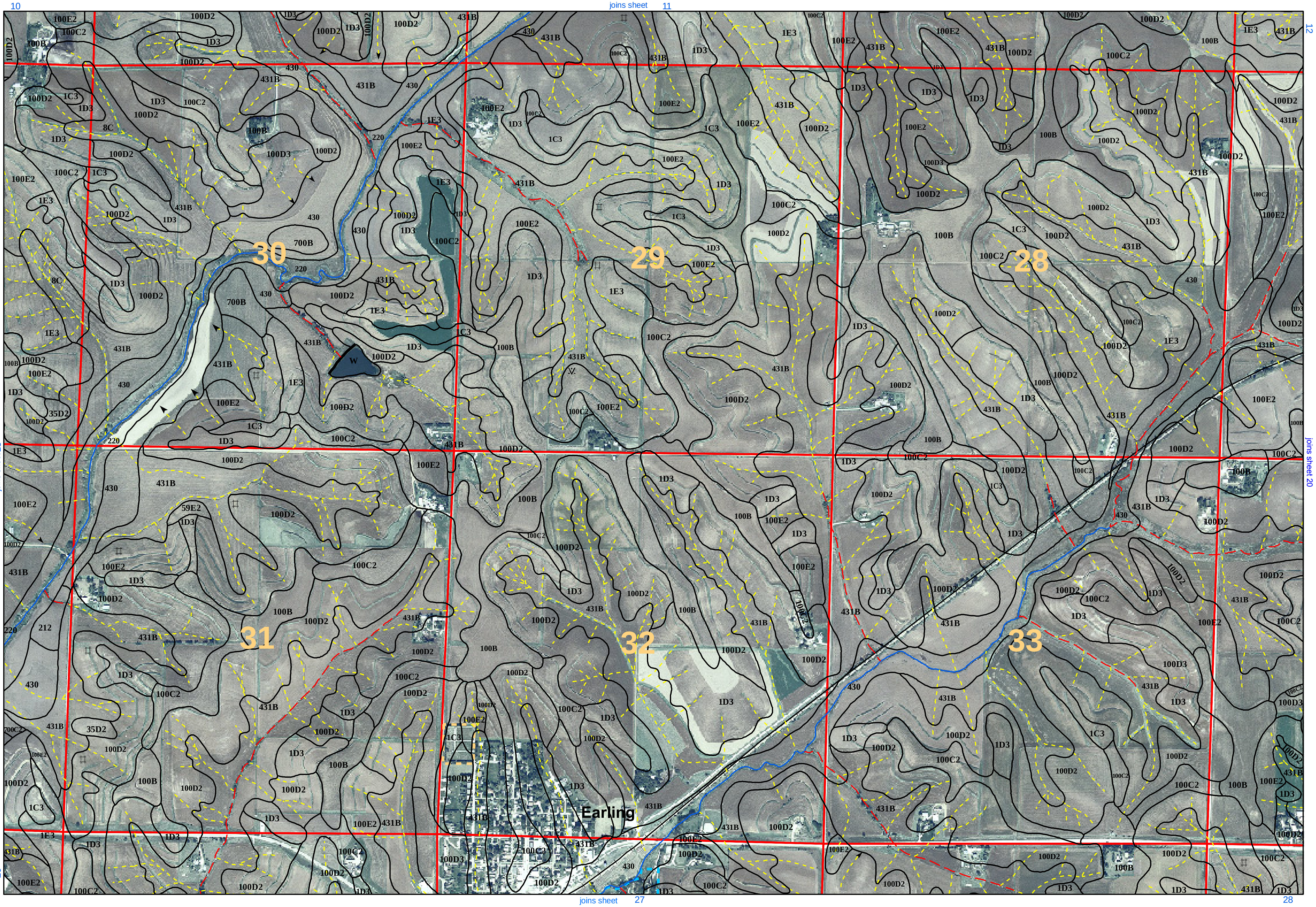
NRCS Natural Resources Conservation Service

# Township 81N Range 39W



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# Township 81N Range 39W



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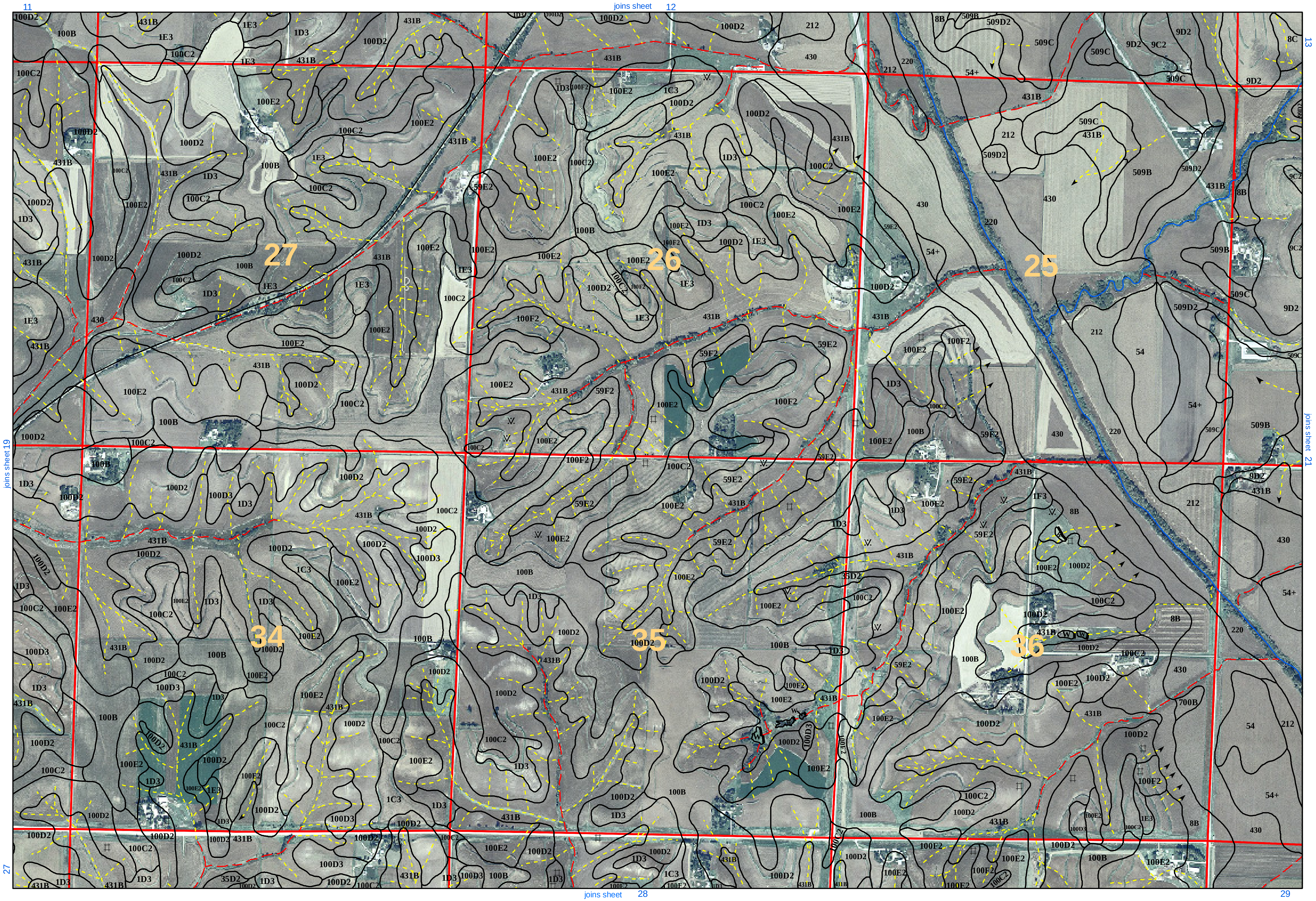


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NRCS Natural Resources Conservation Service

# Township 81N Range 38W

21

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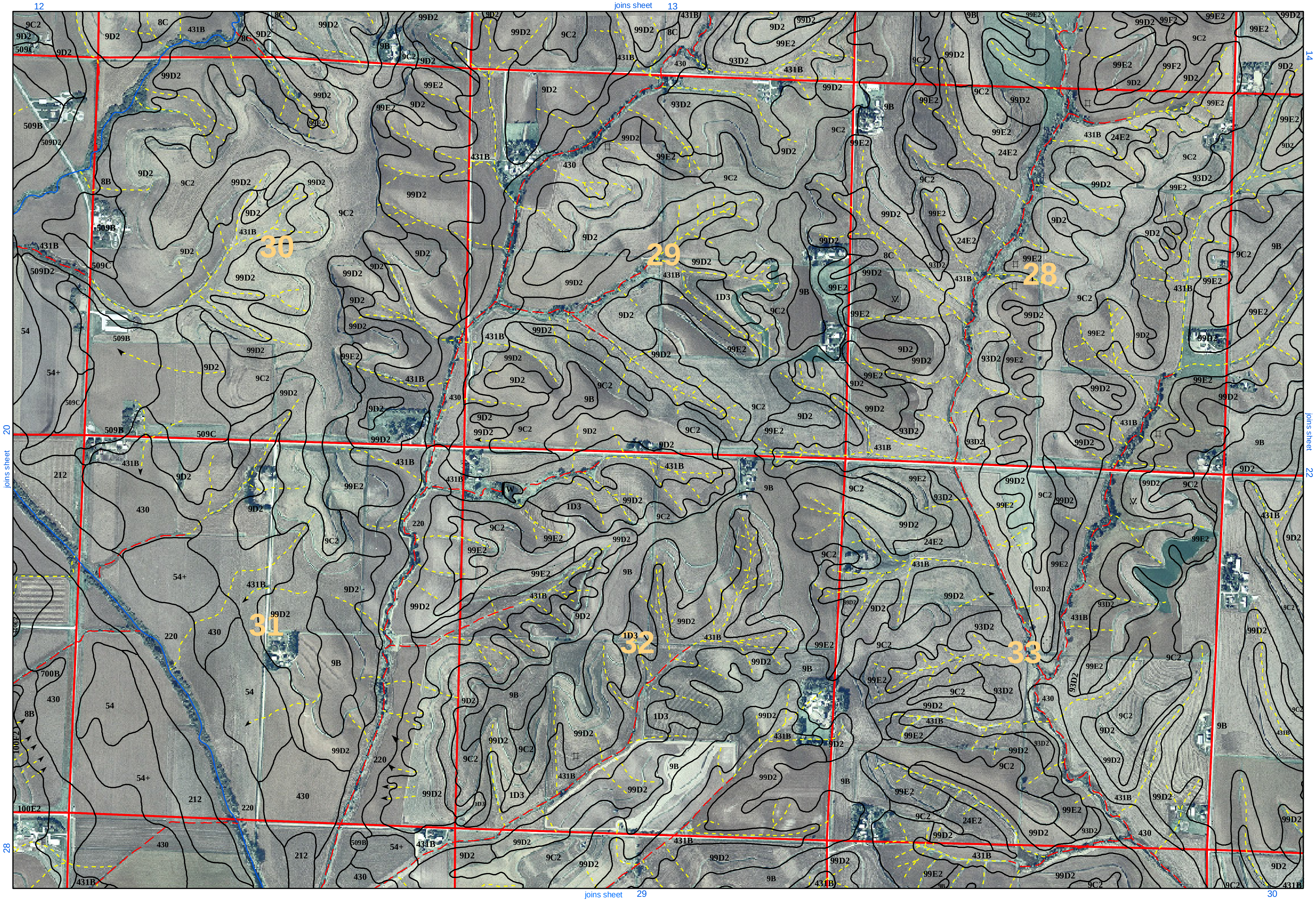


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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United States Department of Agriculture
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# Township 81N Range 38W

22

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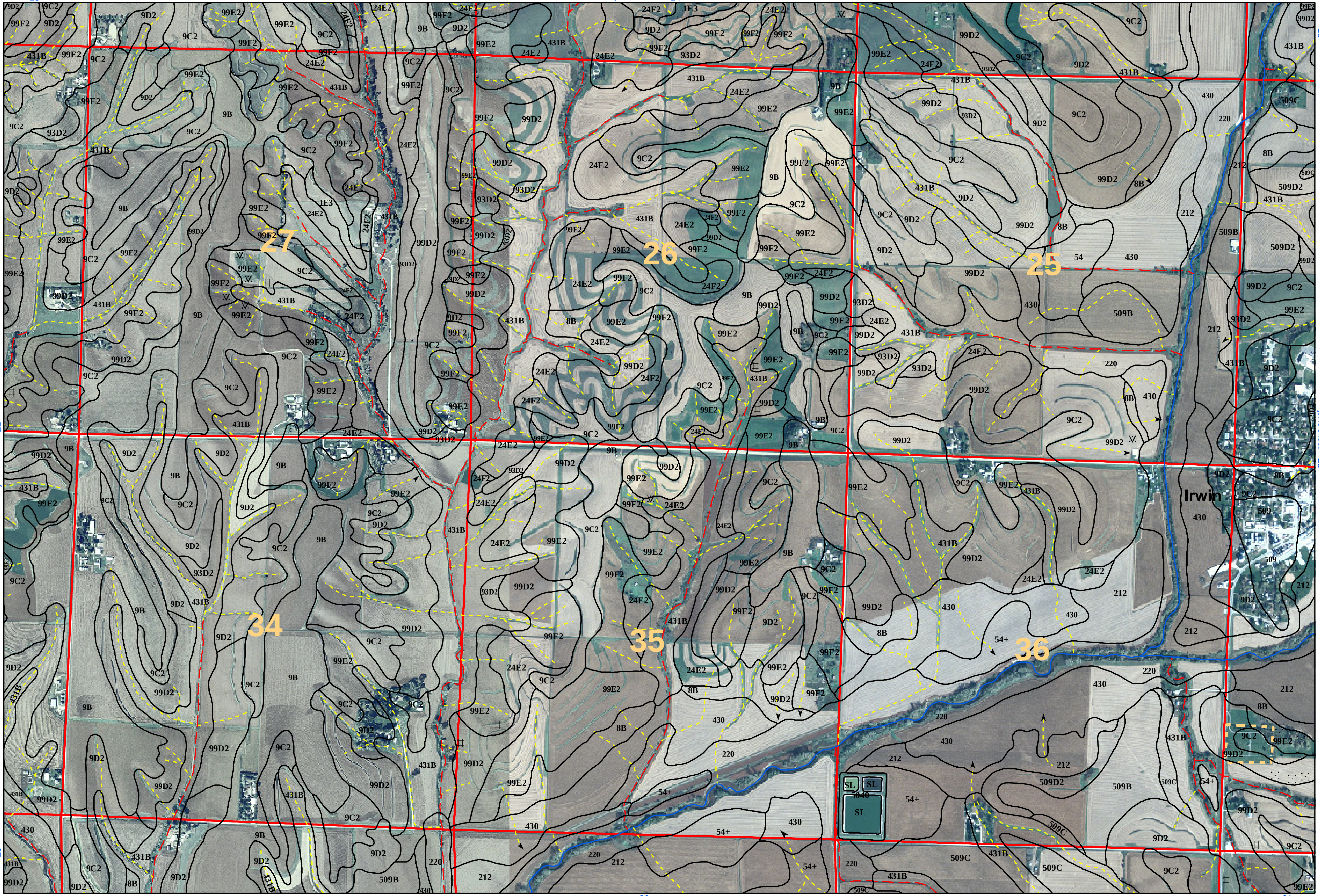


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0 1/4 1/2 3/4 1 Miles

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# Township 81N Range 37W



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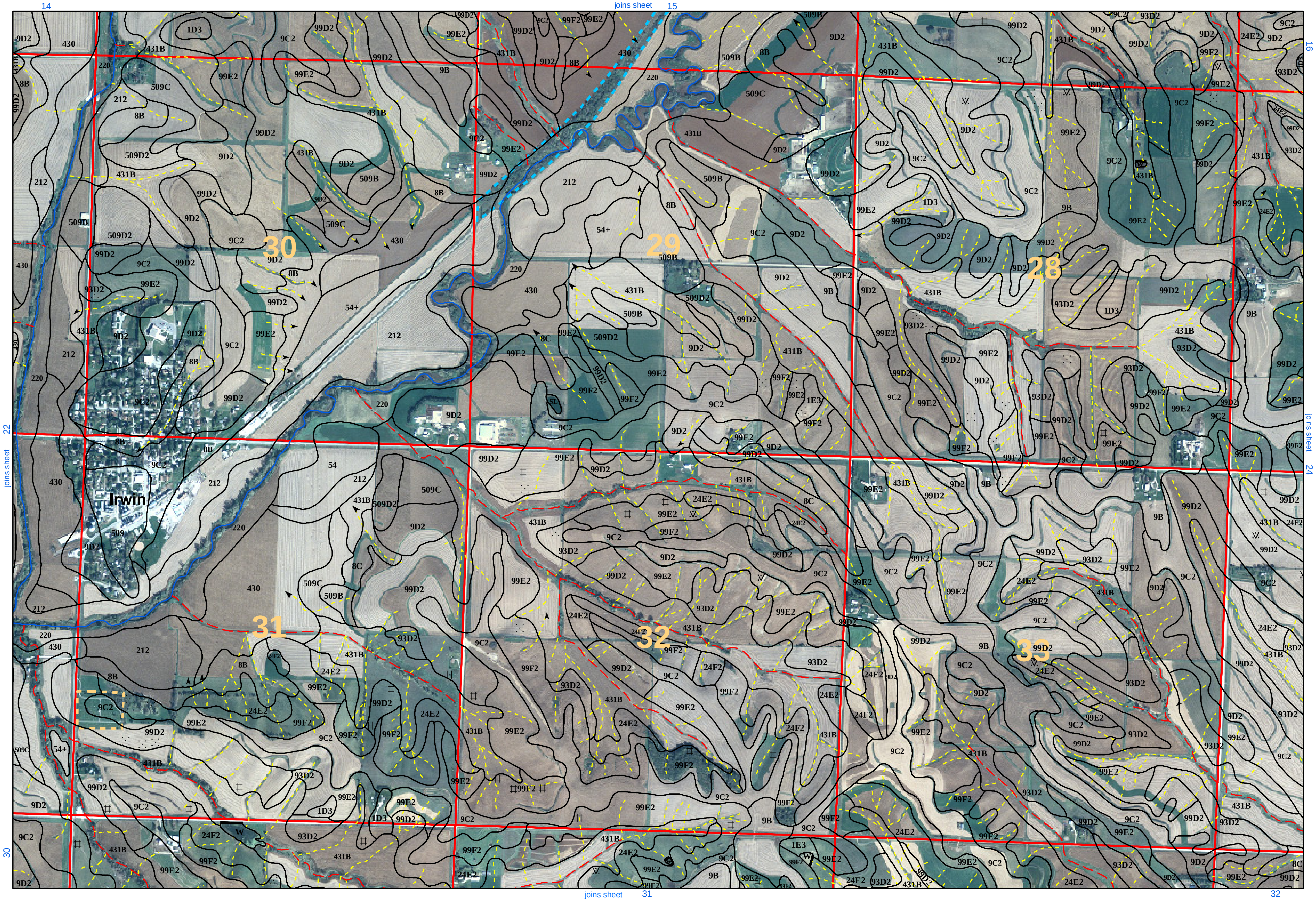


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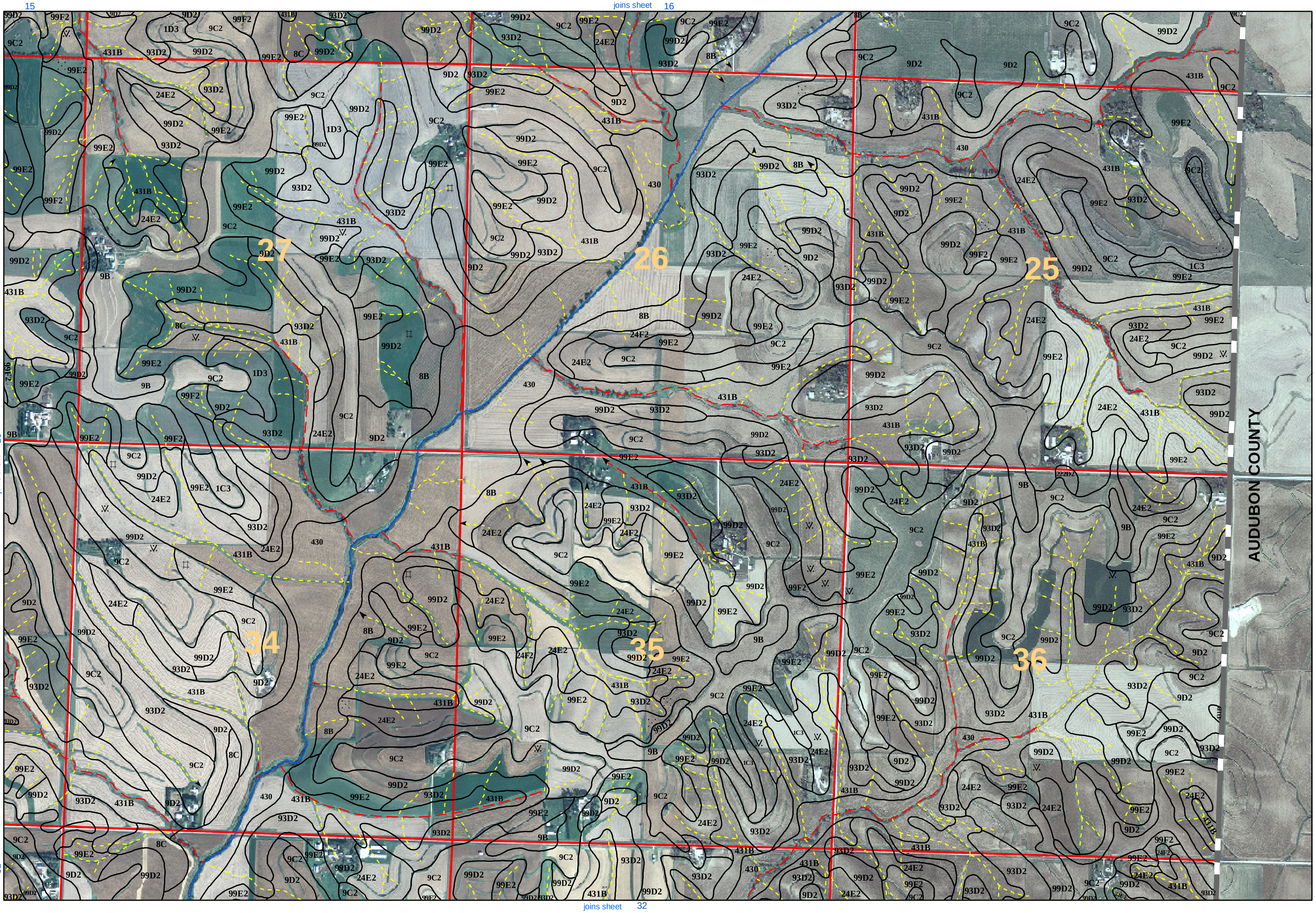
0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 81N Range 37W

24

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0 1,000 2,000 3,000 4,000 5,000 Feet

United States Department of Agriculture
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# Township 80N Range 40W



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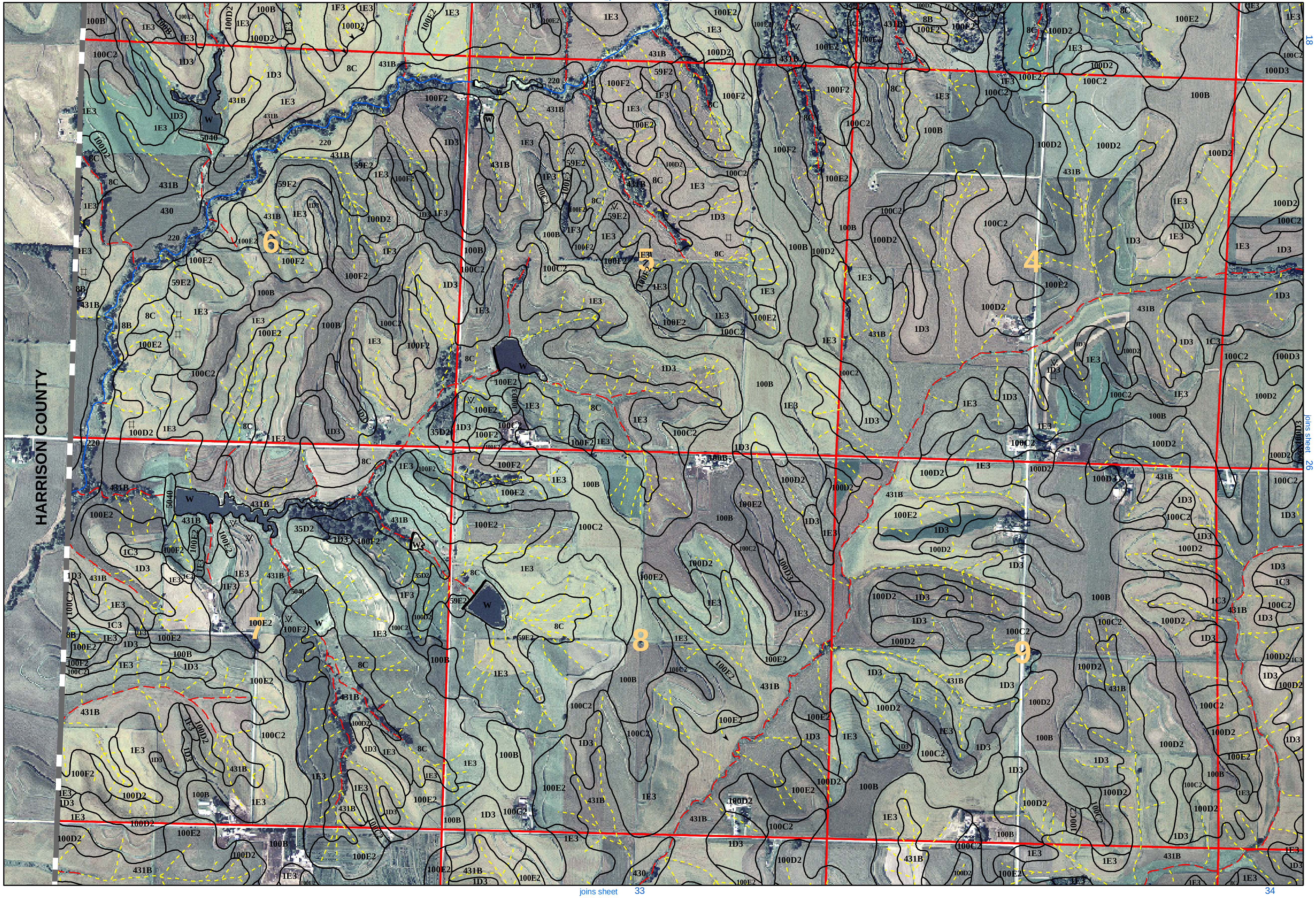


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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 80N Range 40W

26

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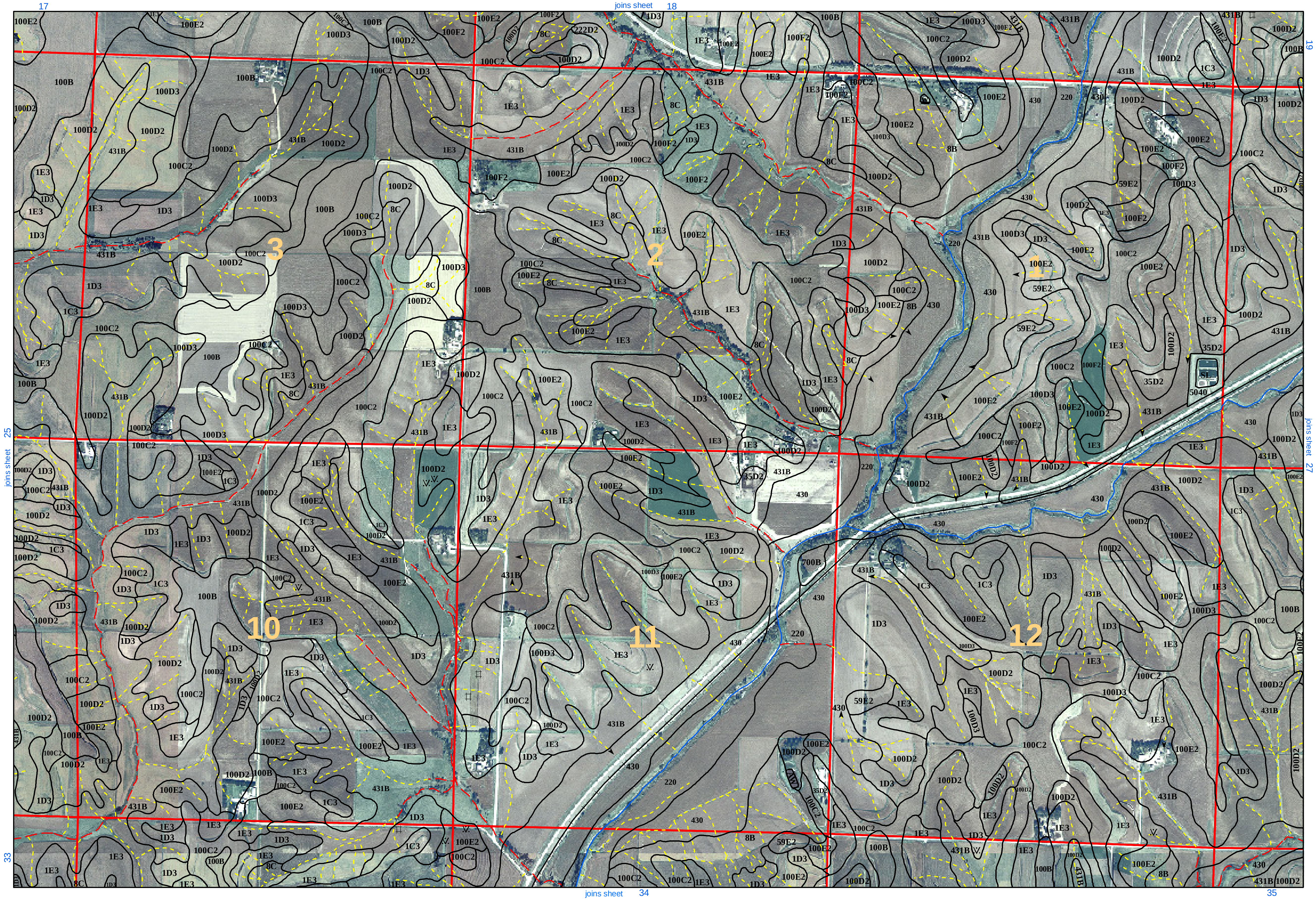


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# Township 80N Range 39W

27

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28

# Township 80N Range 39W

28

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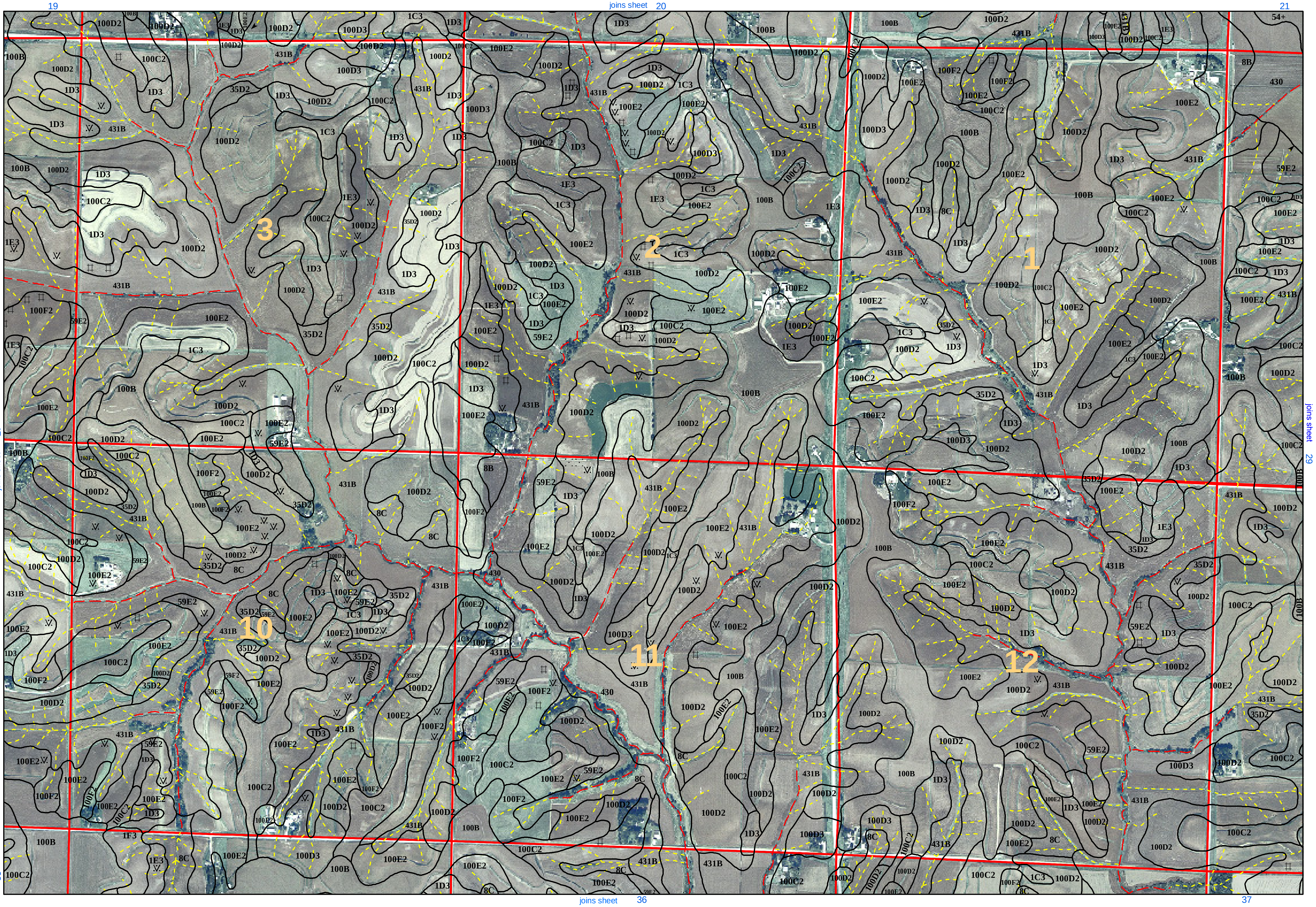


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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

United States Department of Agriculture
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# Township 80N Range 38W

29

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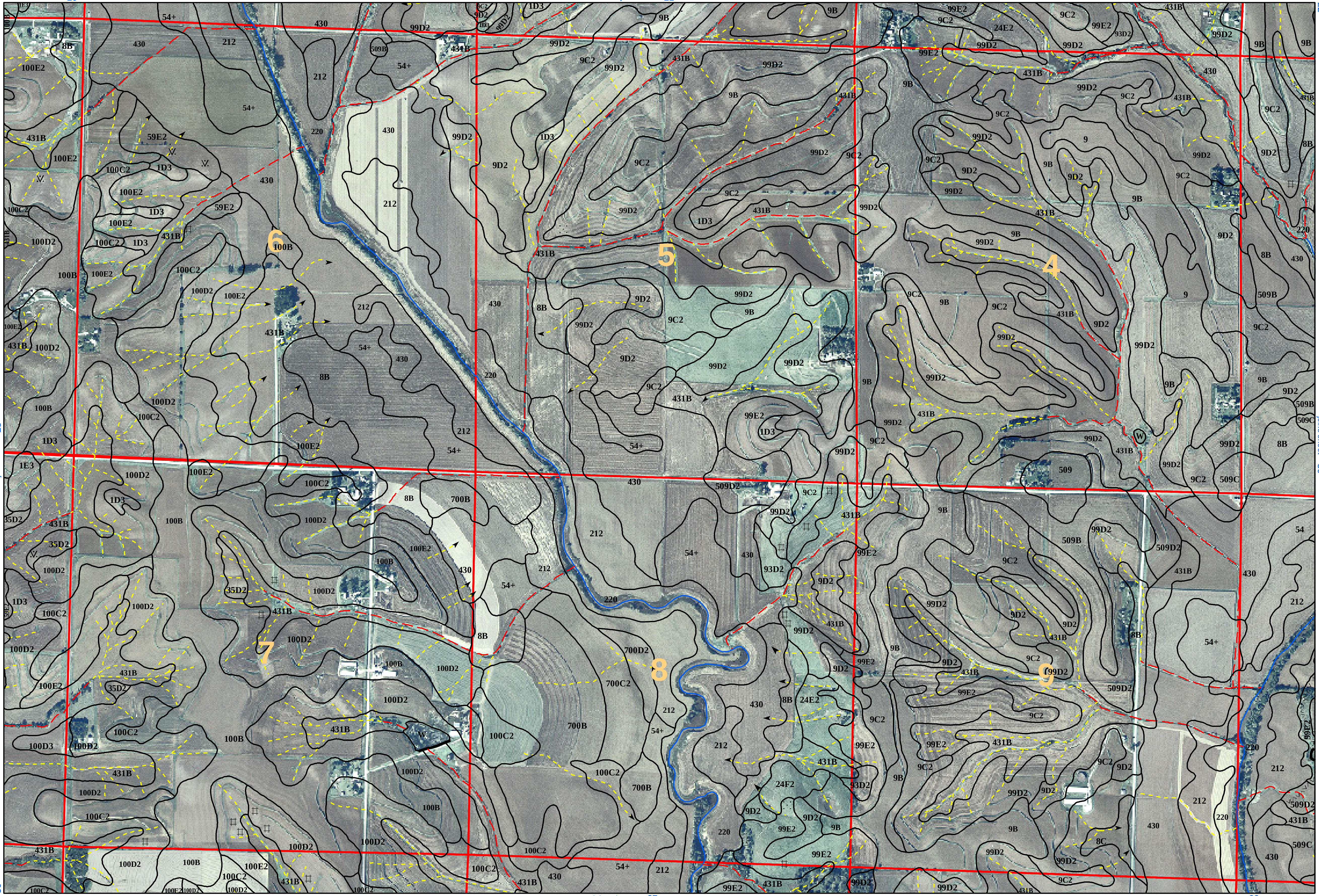


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0 1/4 1/2 3/4 1 Miles

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# Township 80N Range 38W



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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 80N Range 37W

31

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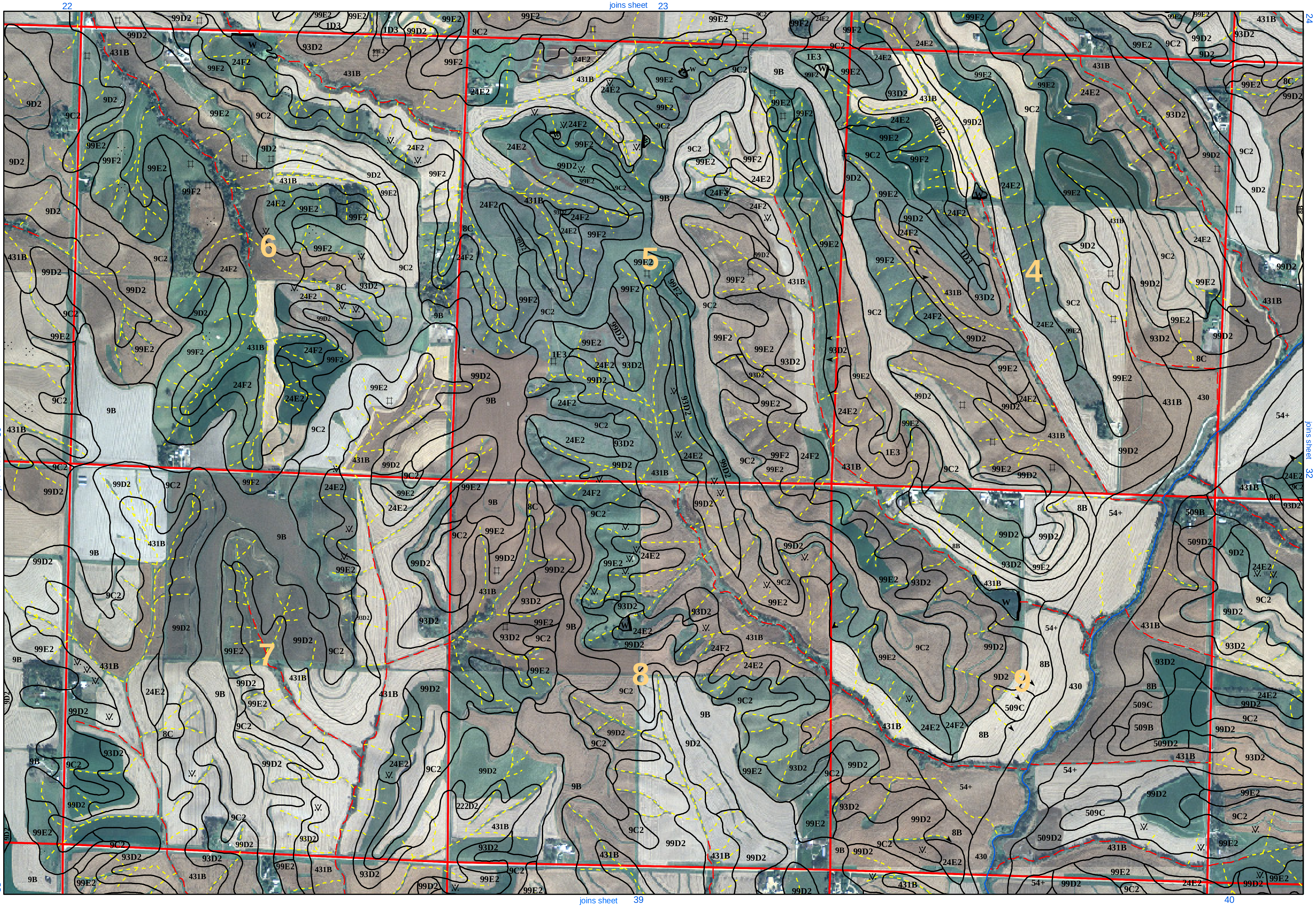


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 80N Range 37W

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# Township 80N Range 40W

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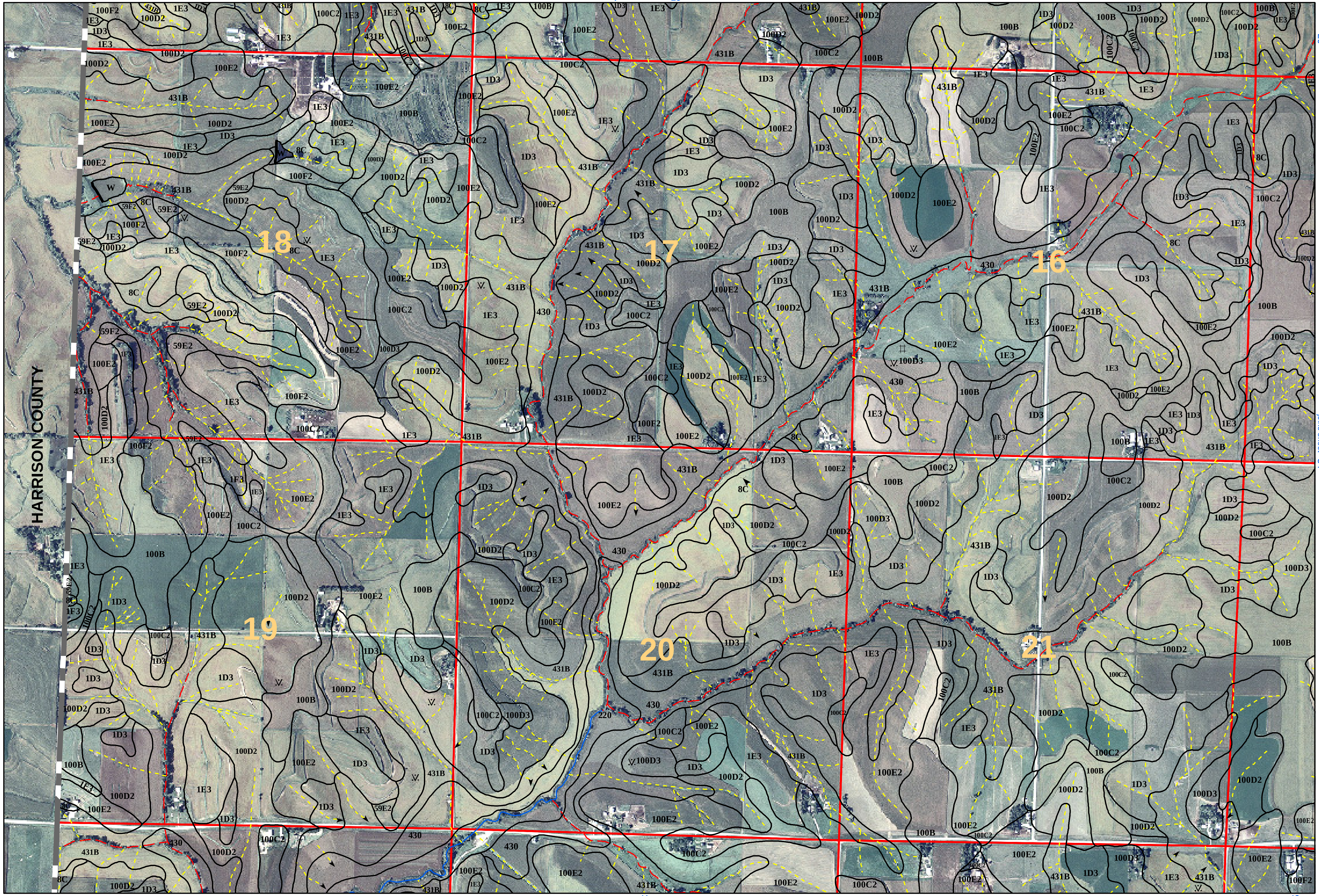


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# Township 80N Range 40W



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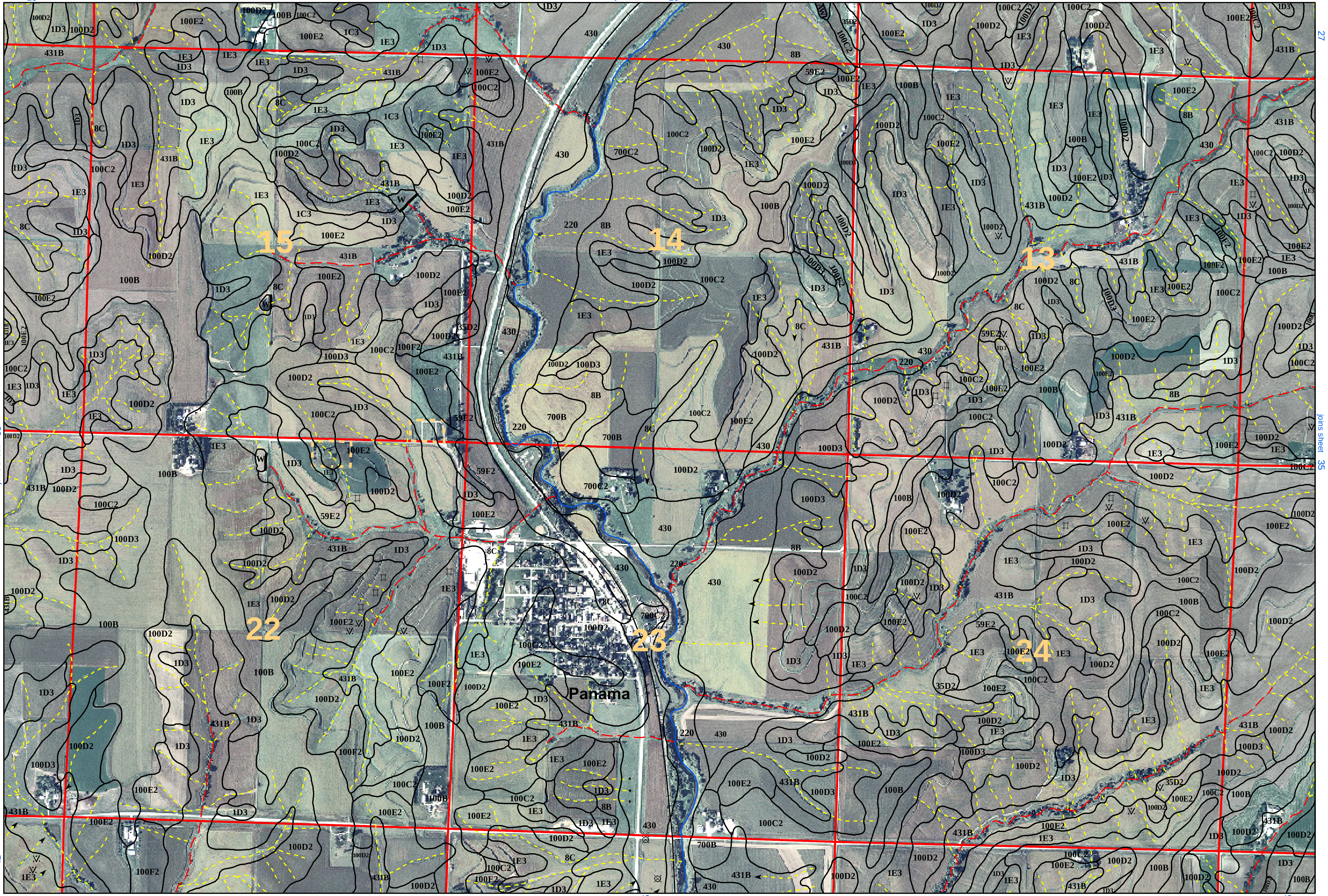


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# Township 80N Range 39W

35

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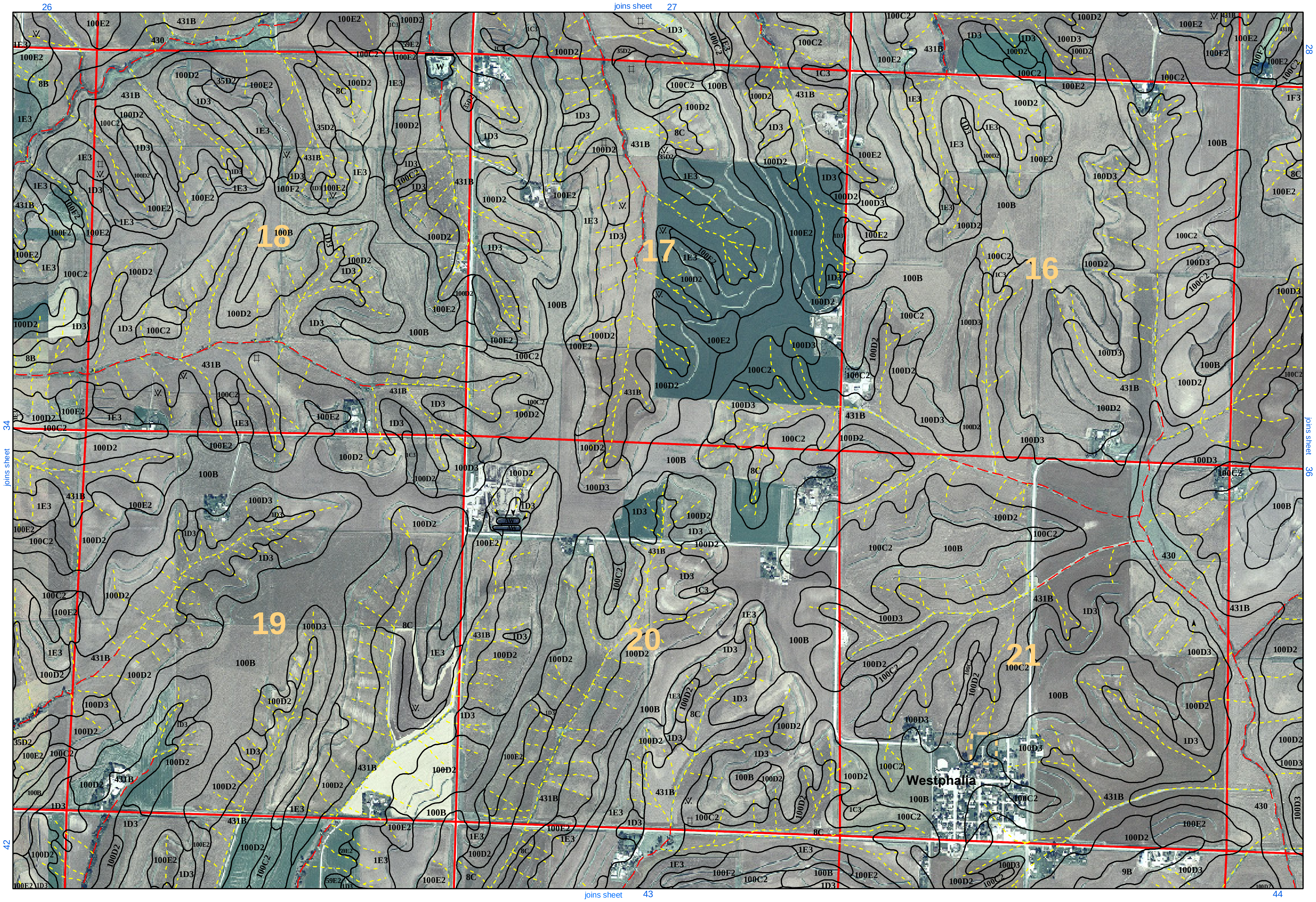


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# Township 80N Range 39W

36

36

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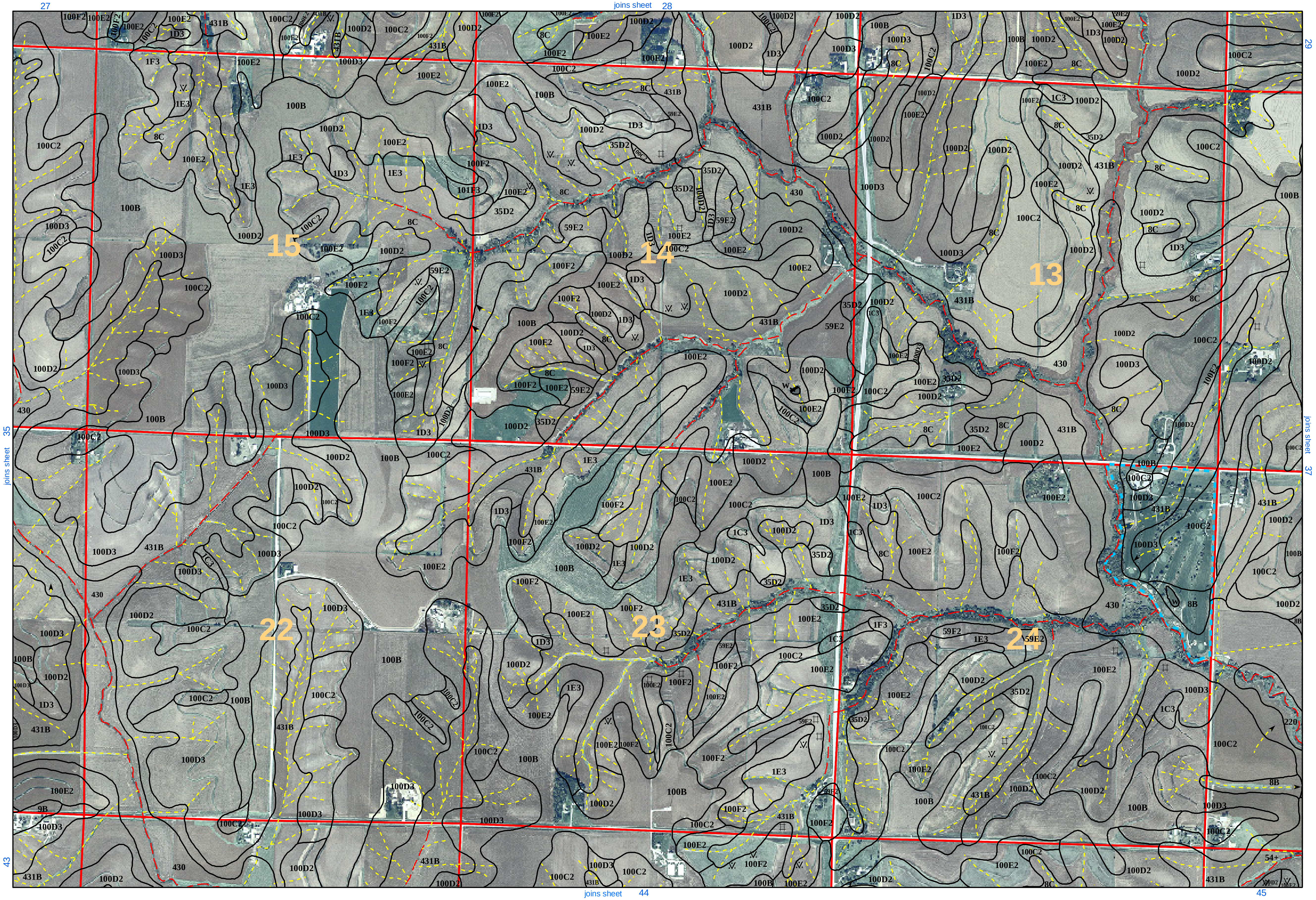


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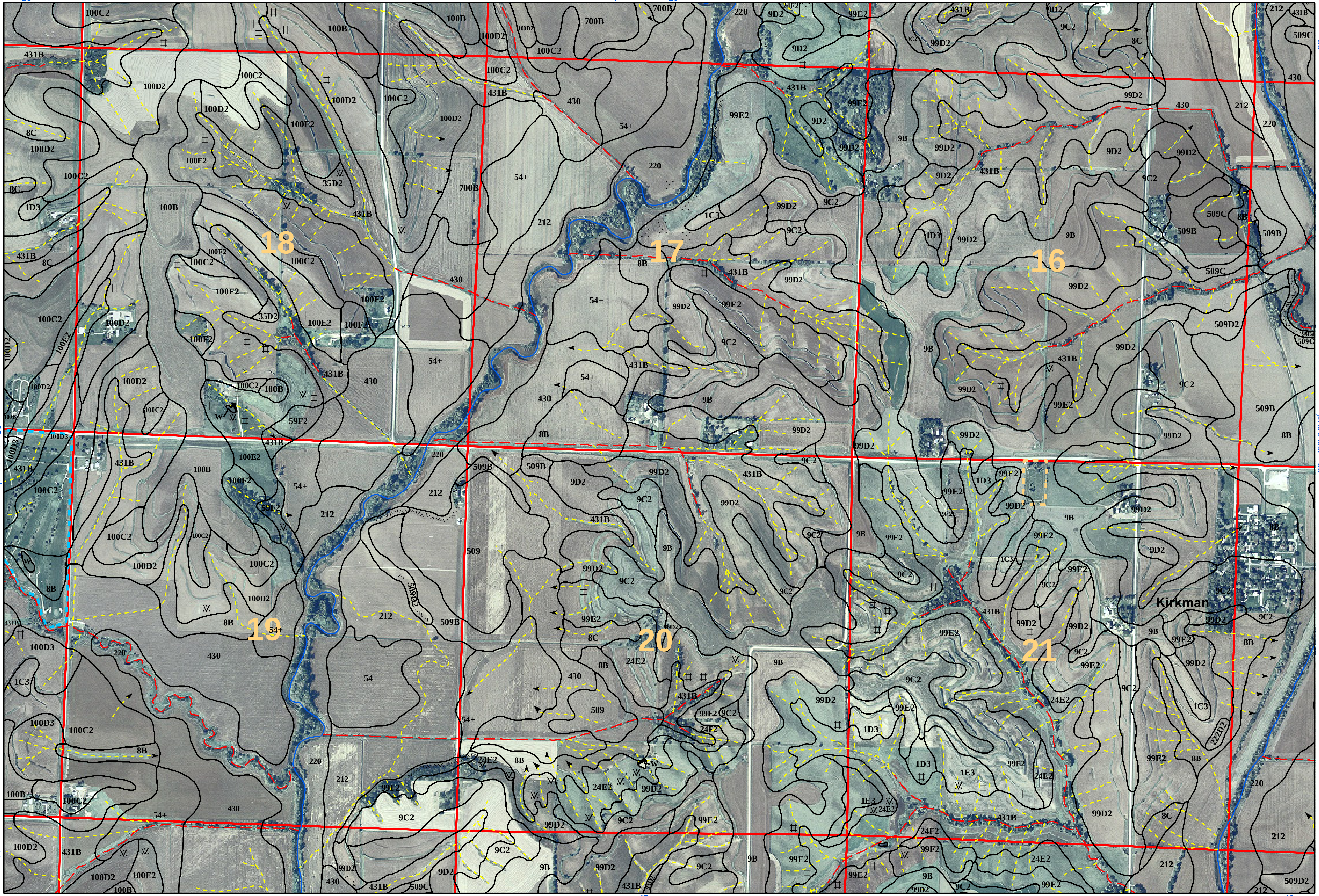
# Township 80N Range 38W



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# Township 80N Range 38W



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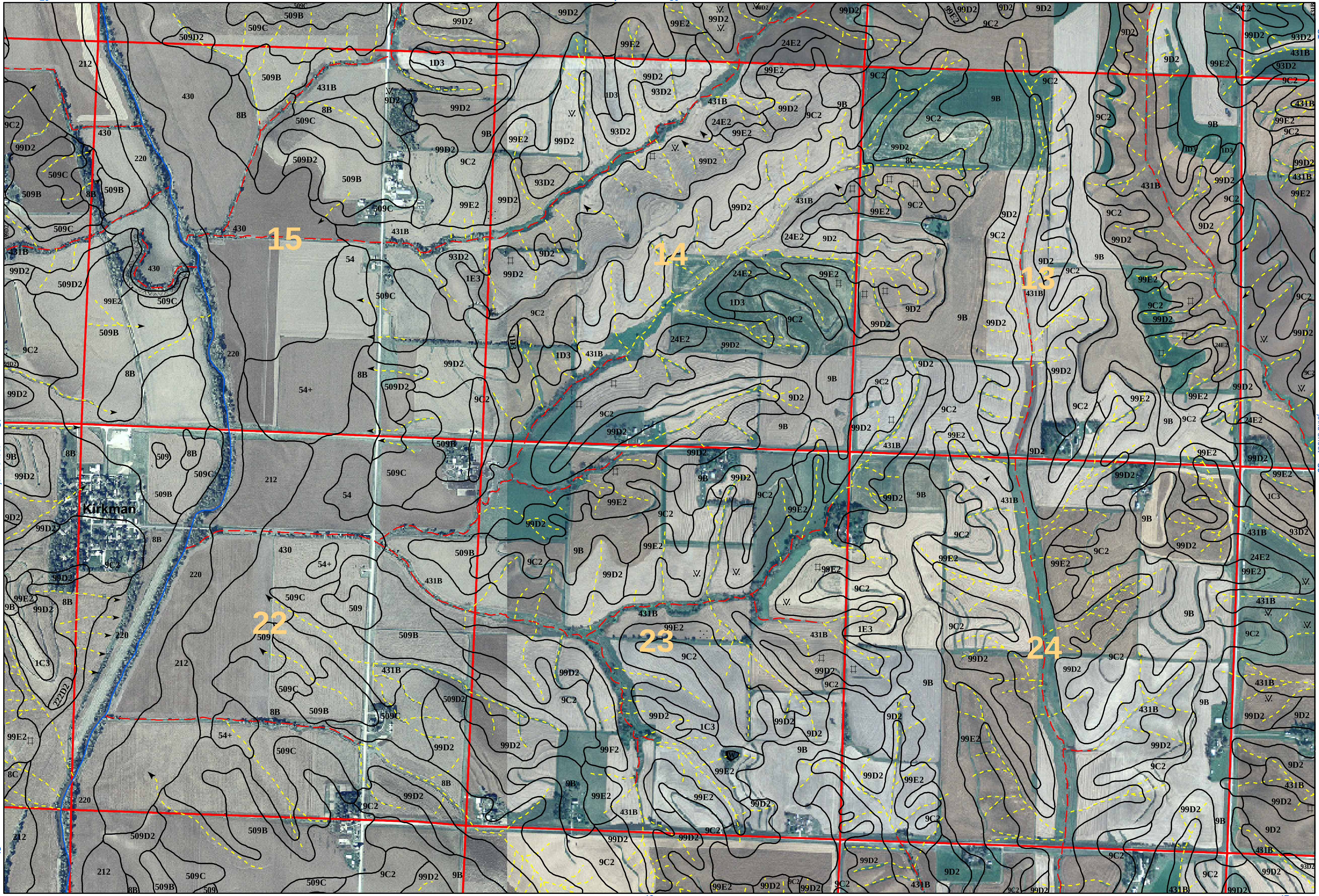


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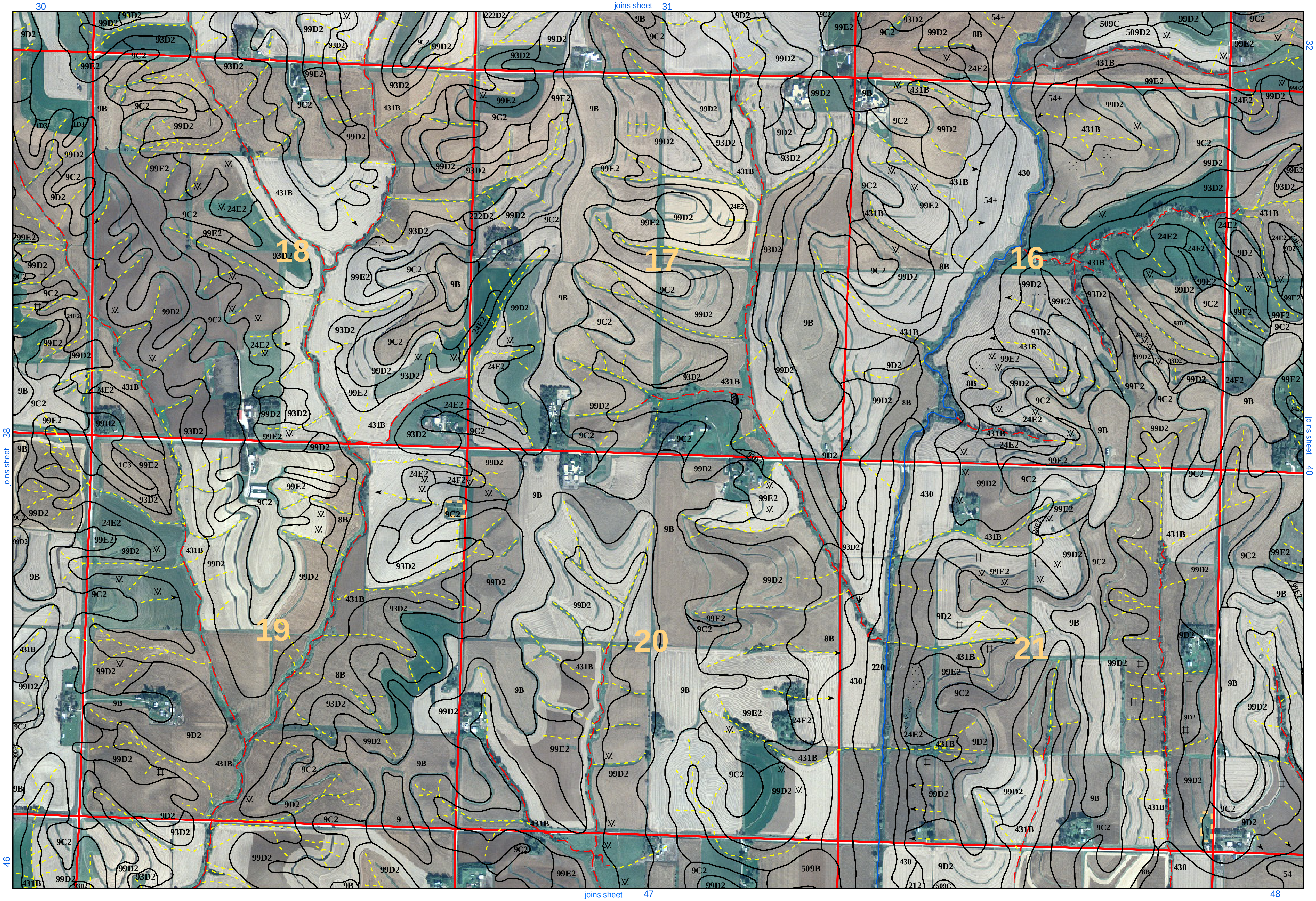
# Township 80N Range 37W

39

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# Township 80N Range 37W

40

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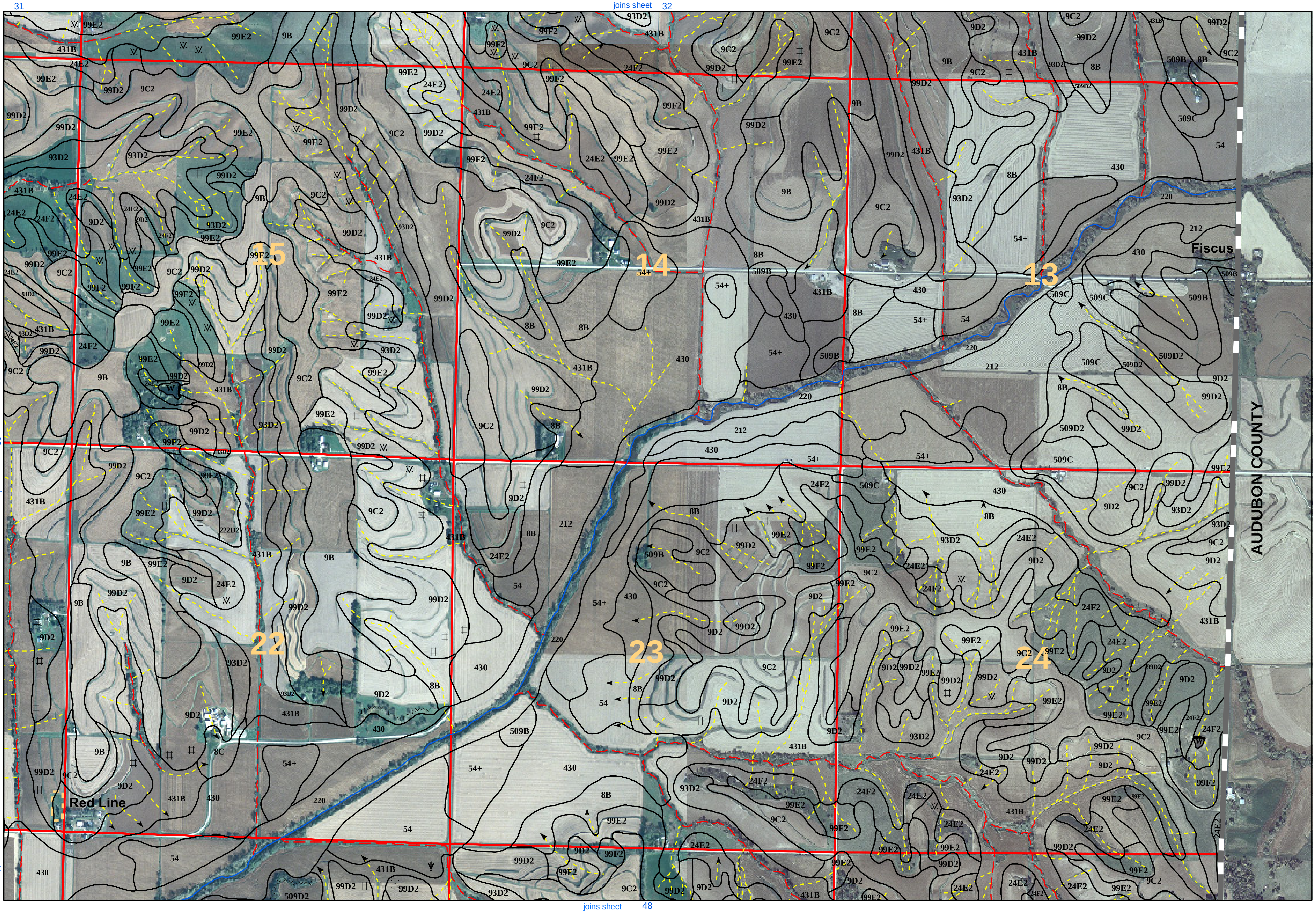


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0 1/4 1/2 3/4 1 Miles

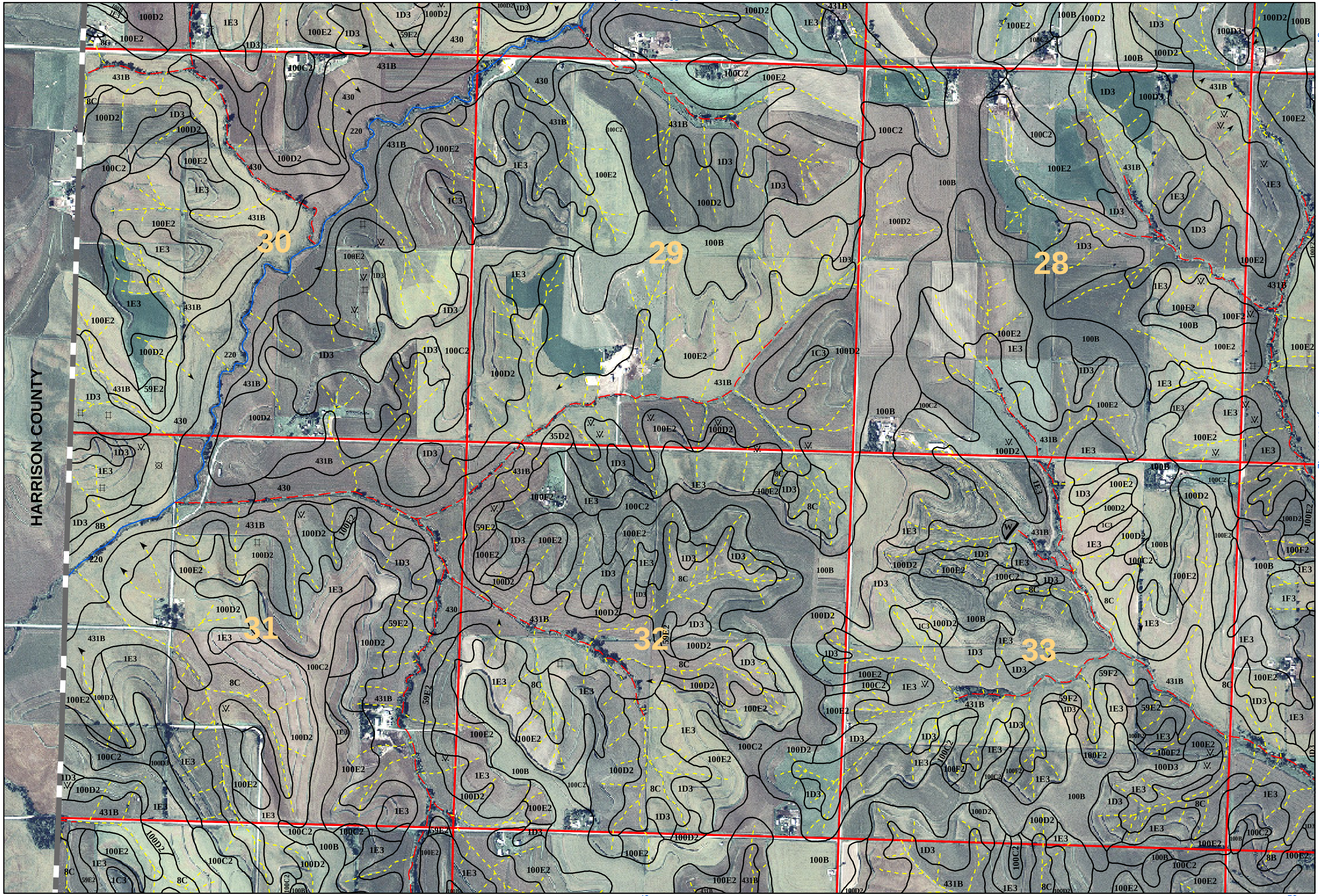
Feet 0 1,000 2,000 3,000 4,000 5,000

United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 80N Range 40W



joins sheet 33




joins sheet 34

joins sheet 42

joins sheet 49

50

N

**Soil Survey of Shelby County, Iowa**

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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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United States Department of Agriculture
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# Township 80N Range 40W



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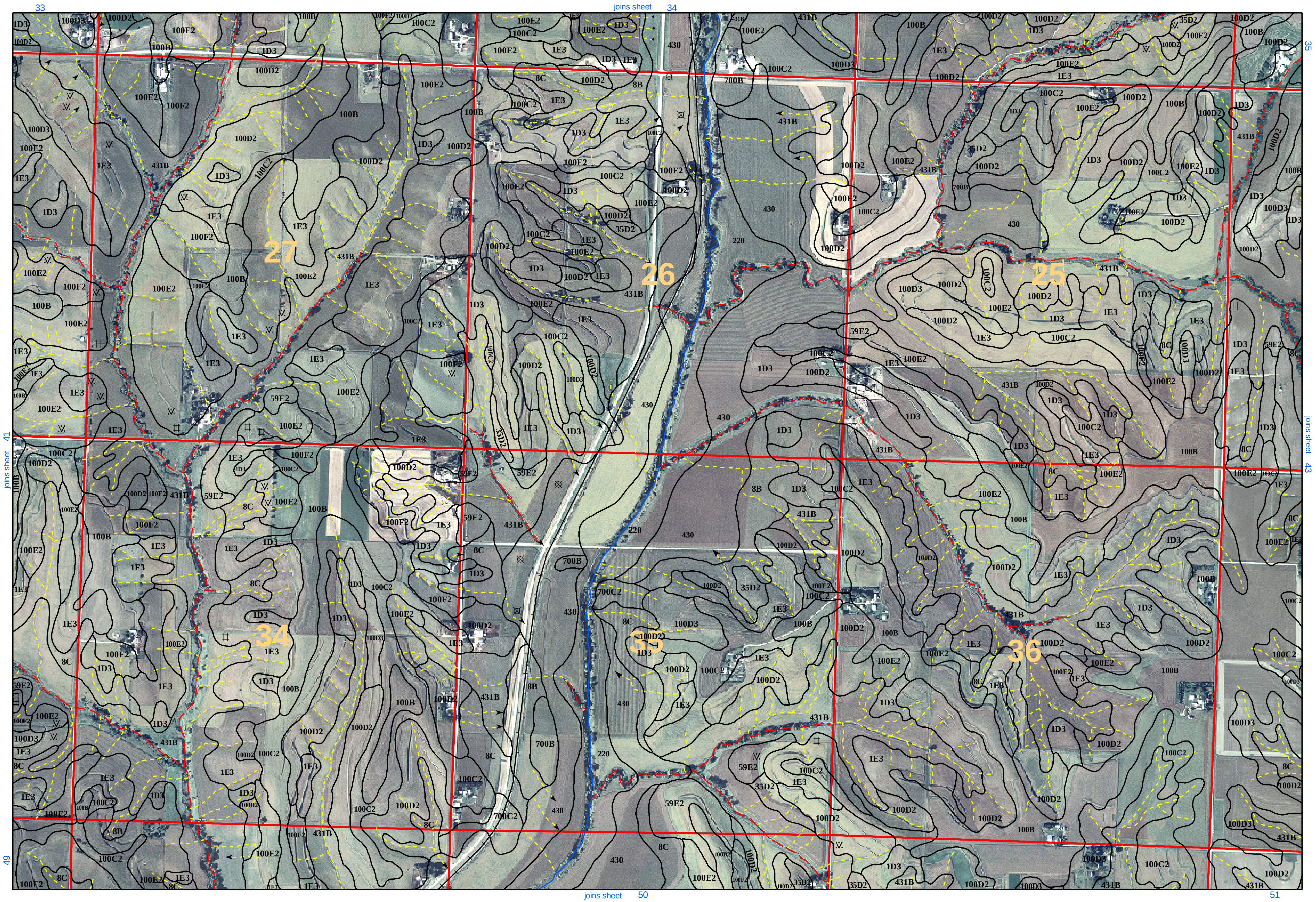


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 80N Range 39W



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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

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# Township 80N Range 39W

44

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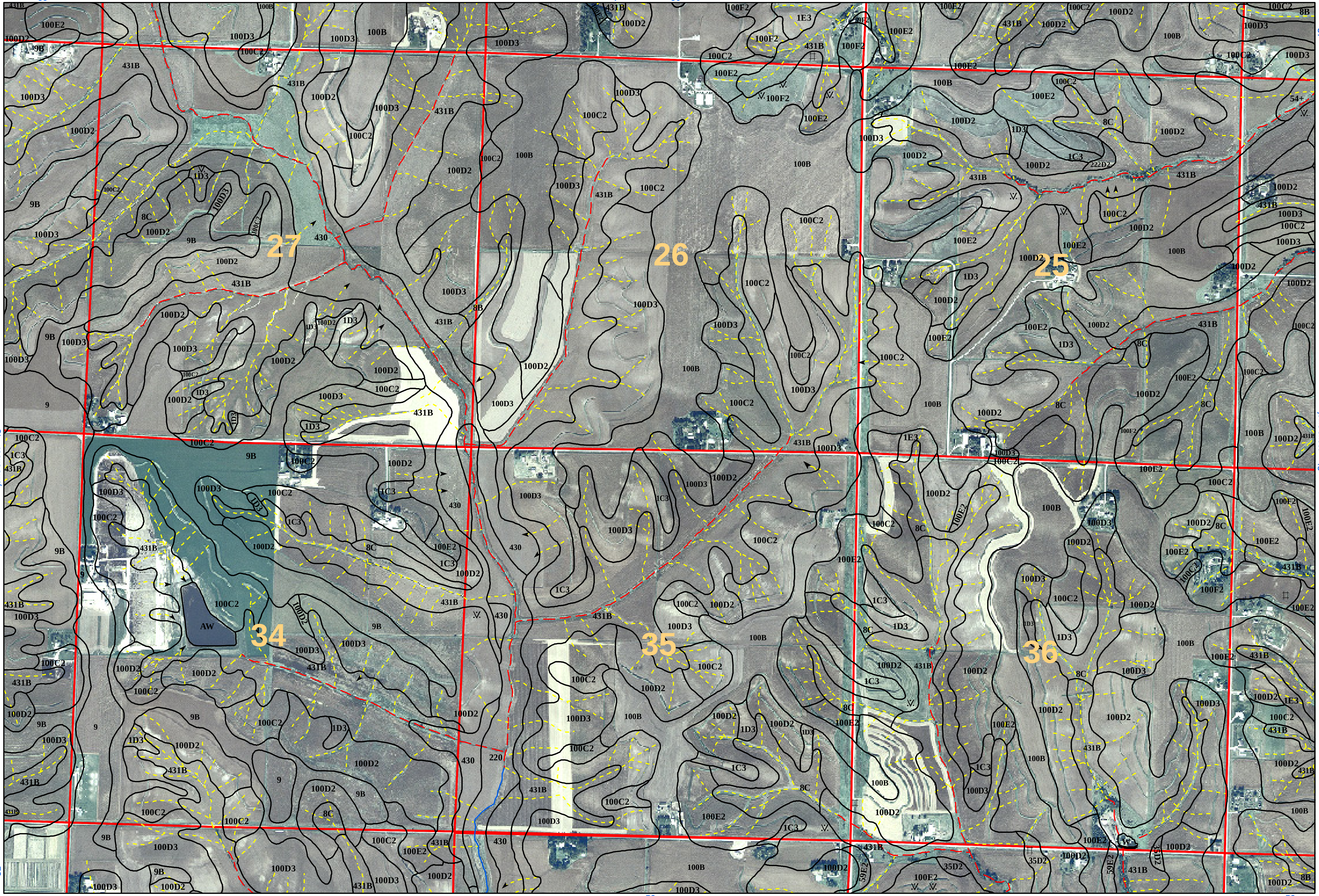
North American Datum of 1983 (NAD83). GRS-80 Spheroid. Universal Transverse Mercator, zone 15.

35 joins sheet 36 37

43 joins sheet 45




51 joins sheet 52 53

0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 80N Range 38W



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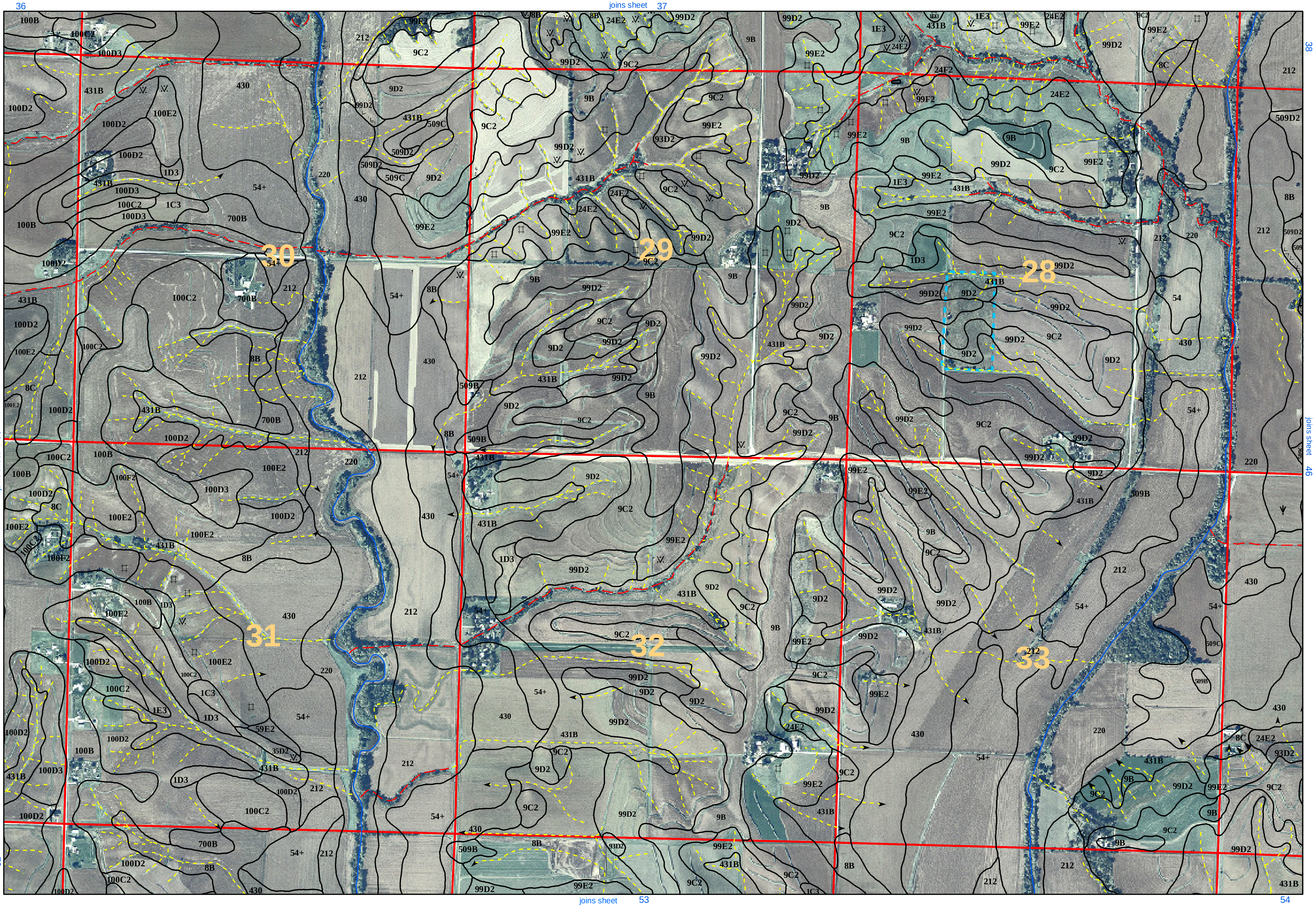


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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 80N Range 38W

46

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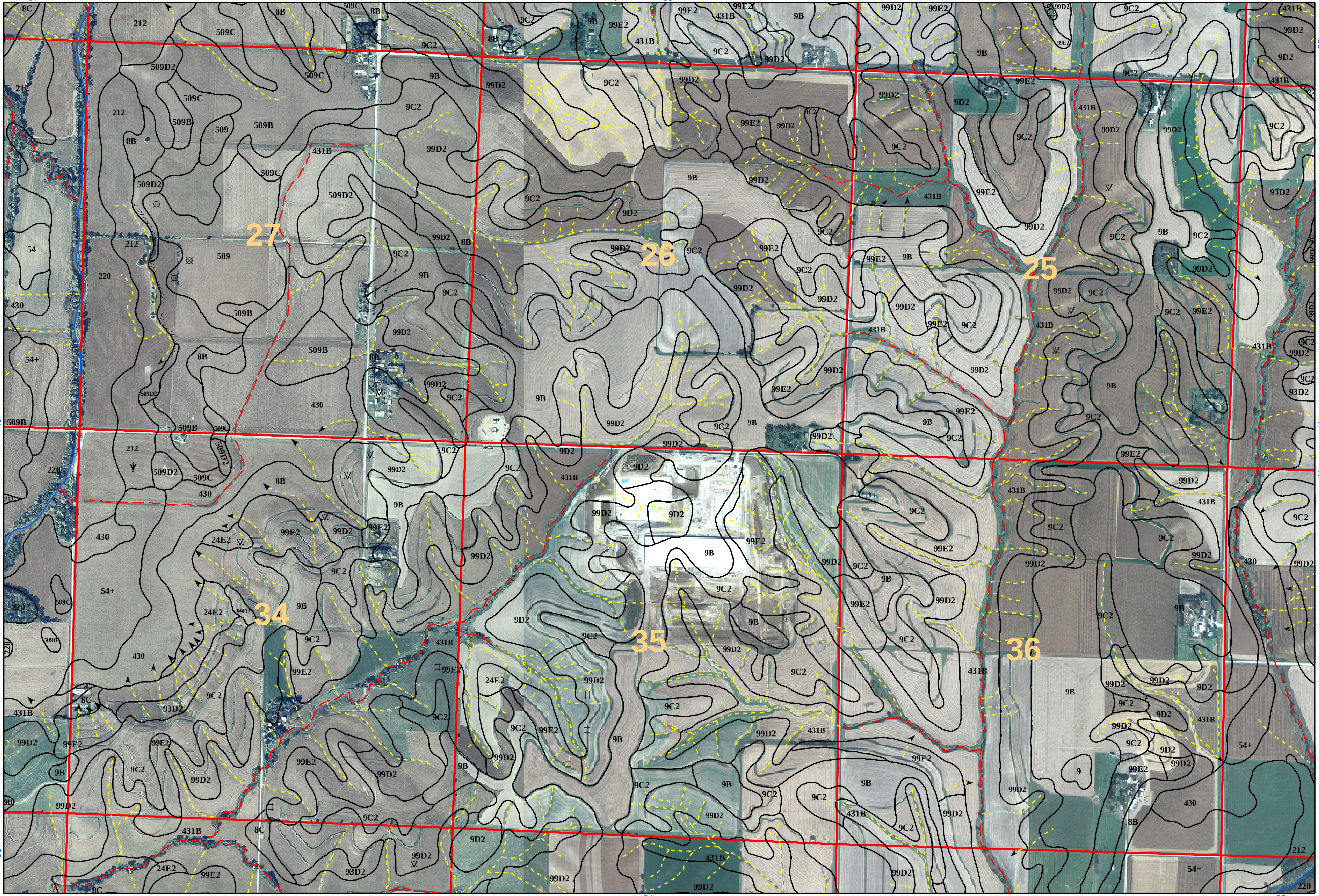


| | | | | | |
|---|---|---|---|---|---|
| 0 | 1/4 | 1/2 | 3/4 | 1 | Miles |
| 0 | 1,000 | 2,000 | 3,000 | 4,000 | 5,000 Feet |

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# Township 80N Range 37W

47

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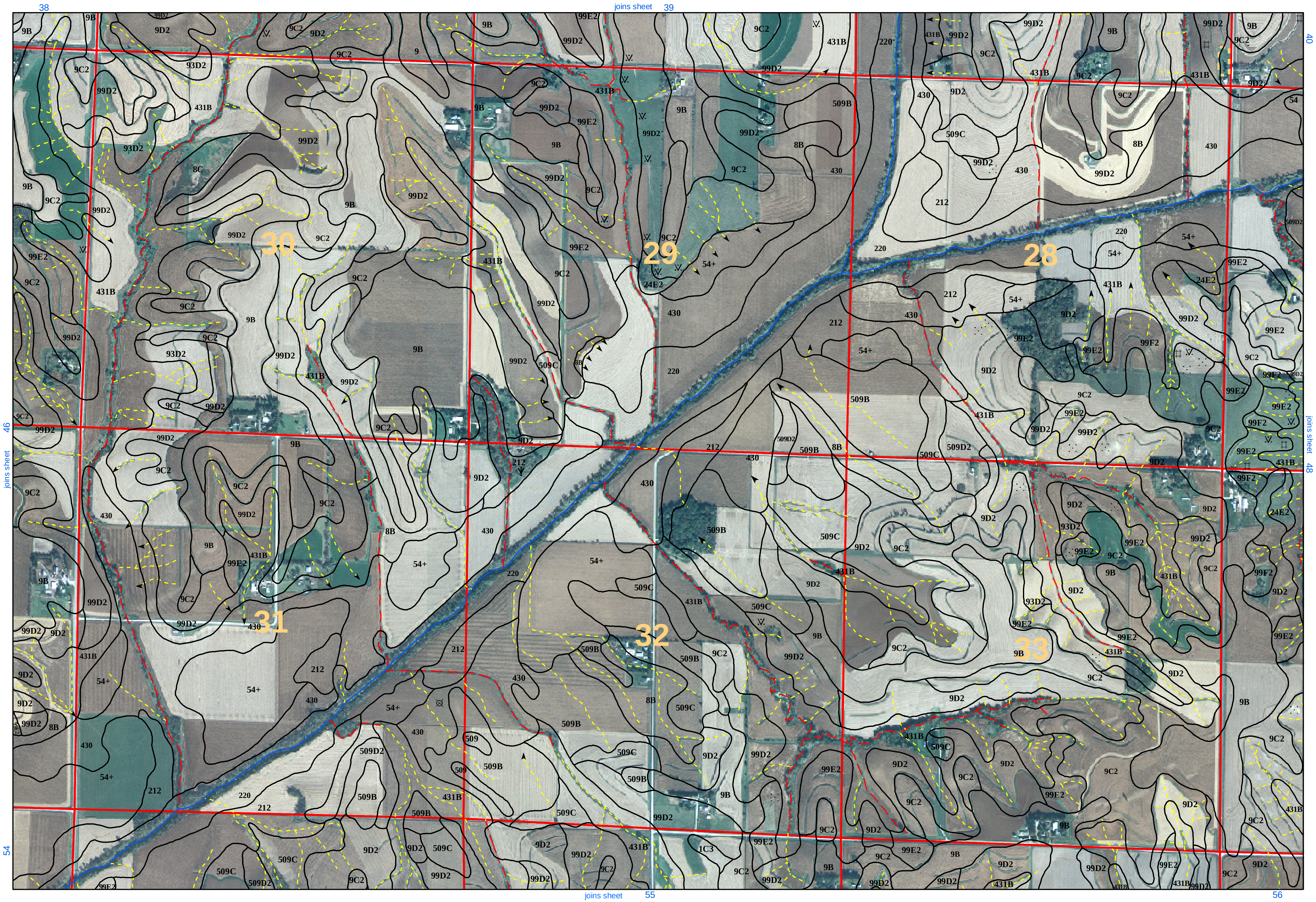


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 80N Range 37W



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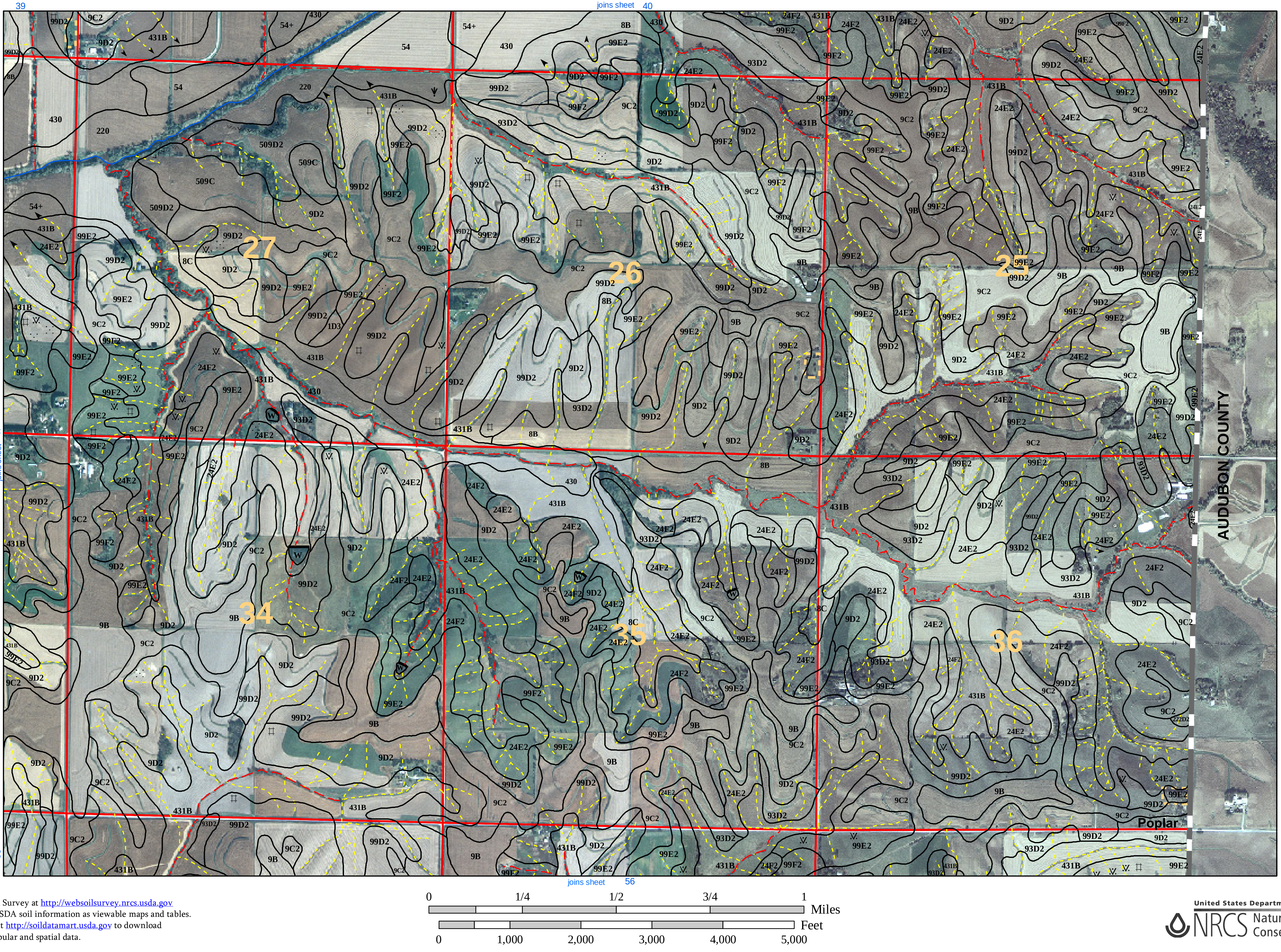


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# Township 79N Range 40W

49

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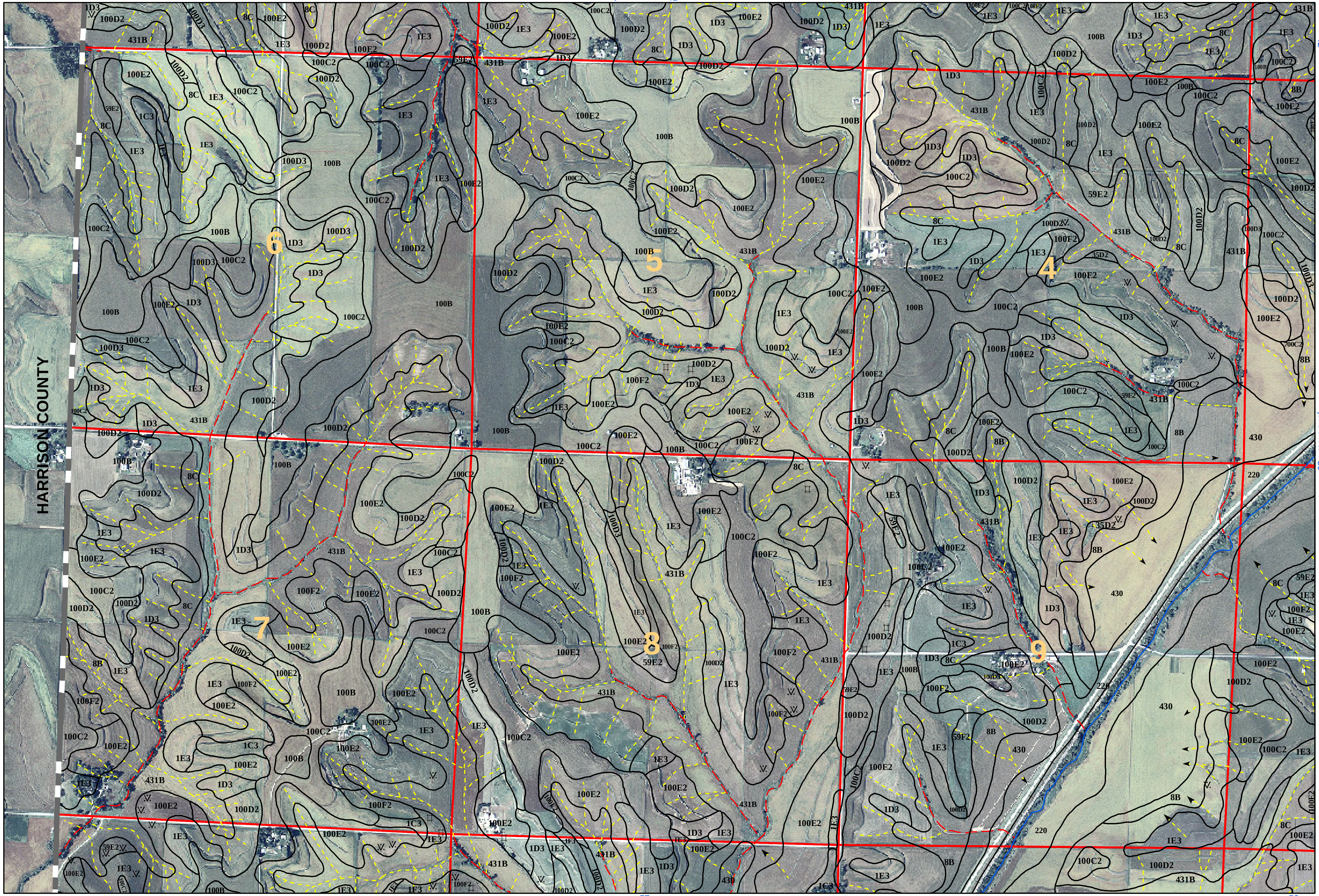
North American Datum of 1983 (NAD83). GRS-80 Spheroid. Universal Transverse Mercator, zone 15.

joins sheet 41




0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

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# Township 79N Range 40W

50

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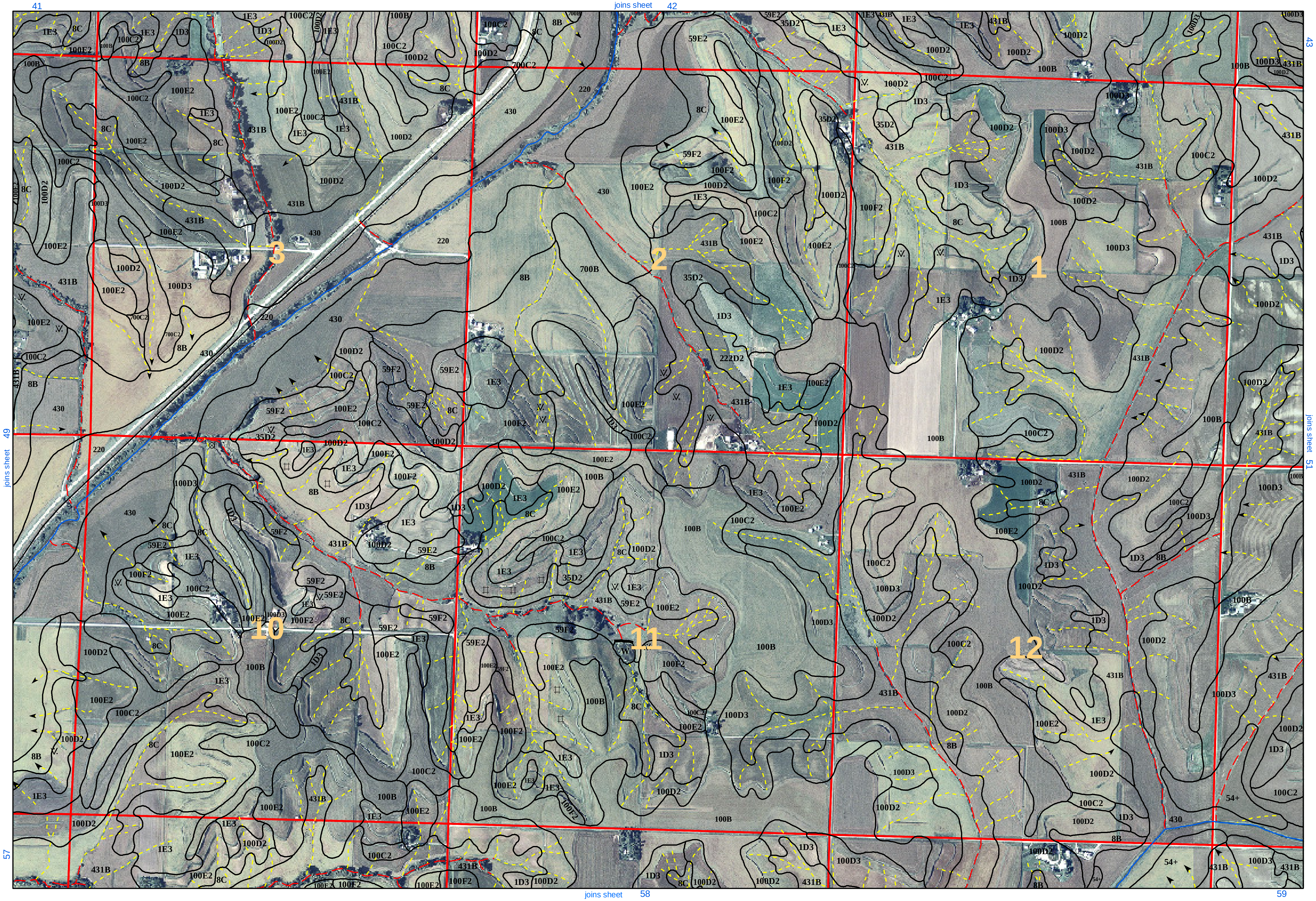


N

0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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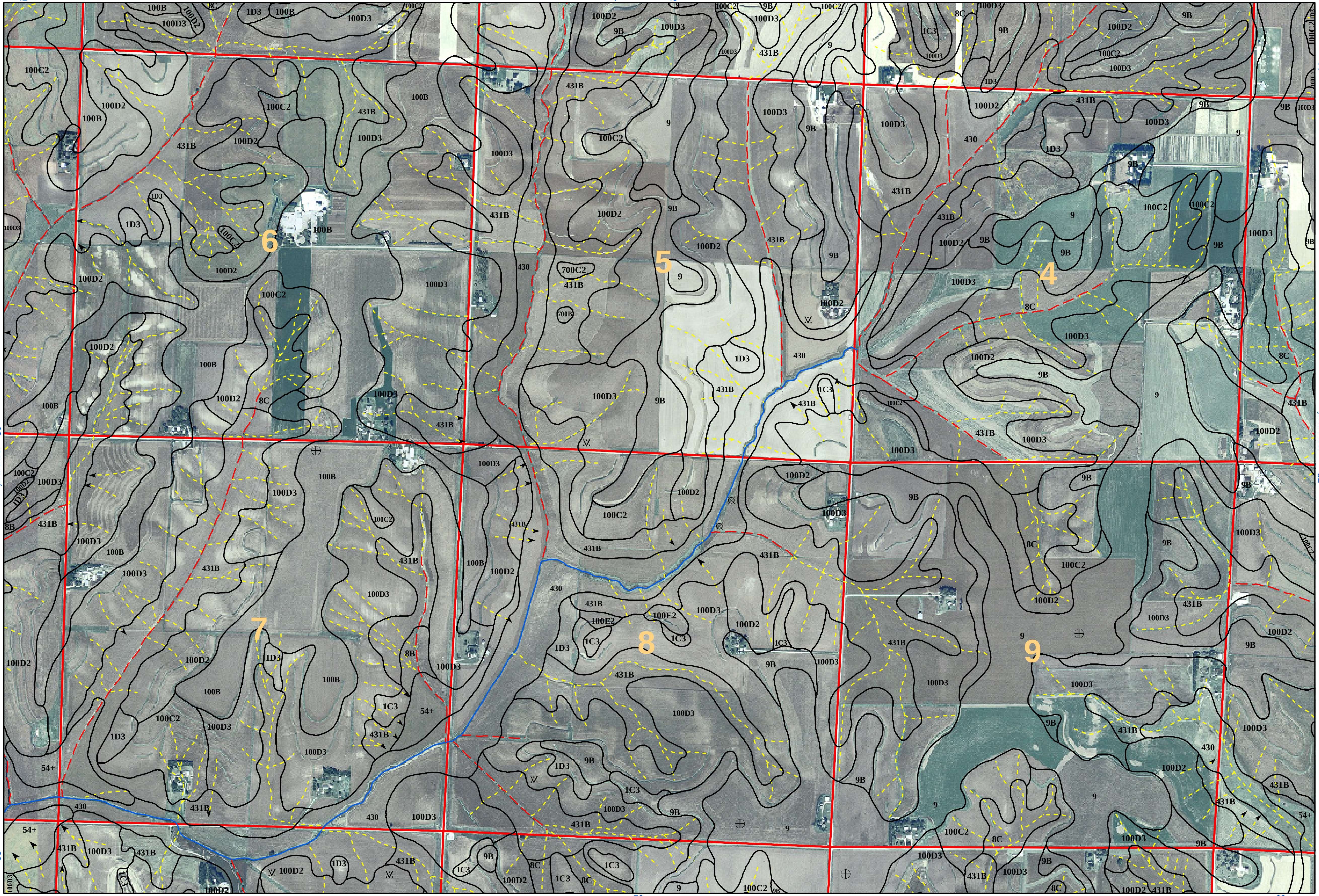
NRCS Natural Resources Conservation Service

# Township 79N Range 39W

51




0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

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# Township 79N Range 39W



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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 79N Range 38W



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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 79N Range 38W

54

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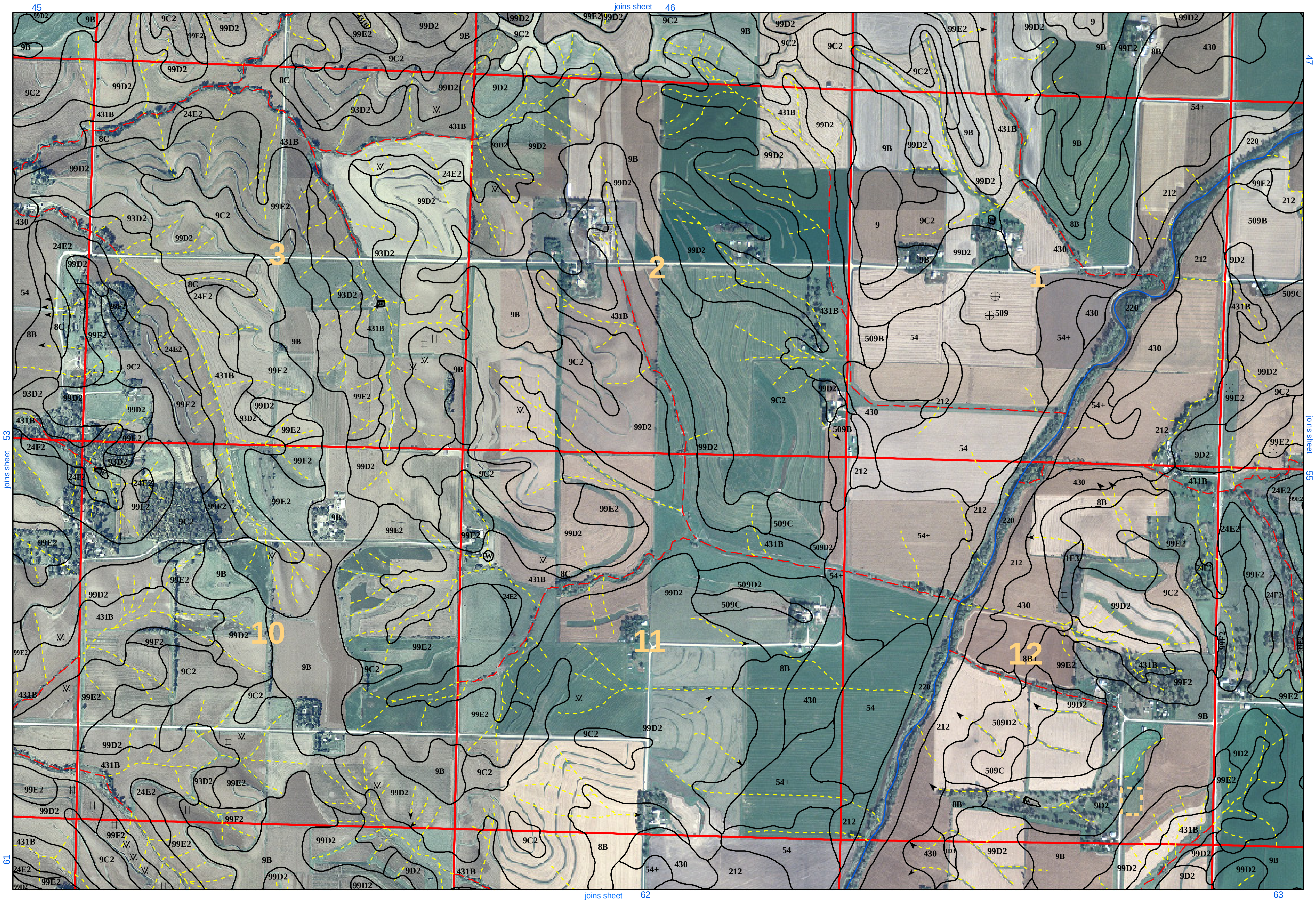


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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 79N Range 37W



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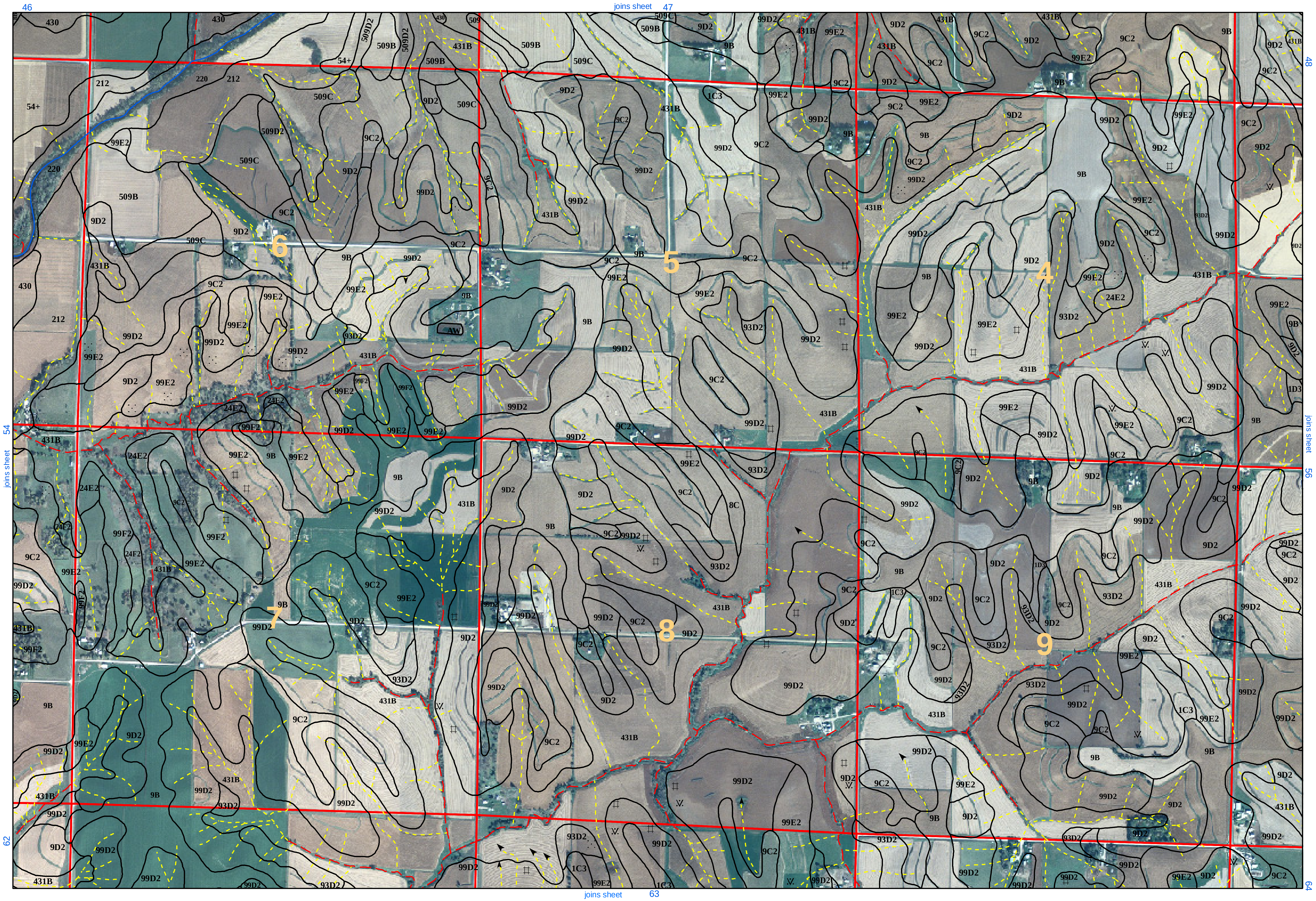


0 | 1/4 | 1/2 | 3/4 | 1 Miles

0 | 1,000 | 2,000 | 3,000 | 4,000 | 5,000 Feet

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# Township 79N Range 37W






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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 79N Range 40W



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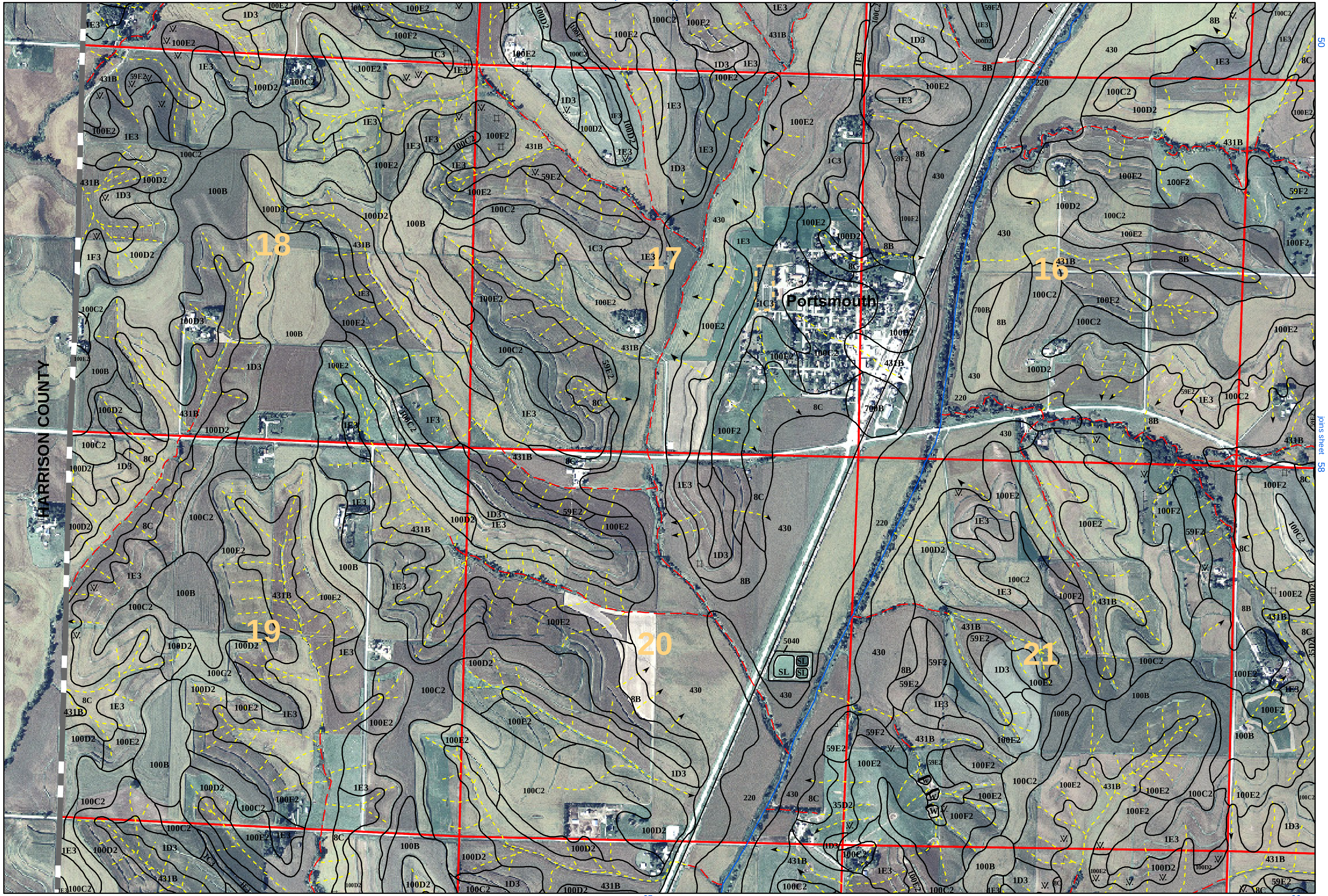


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 79N Range 40W



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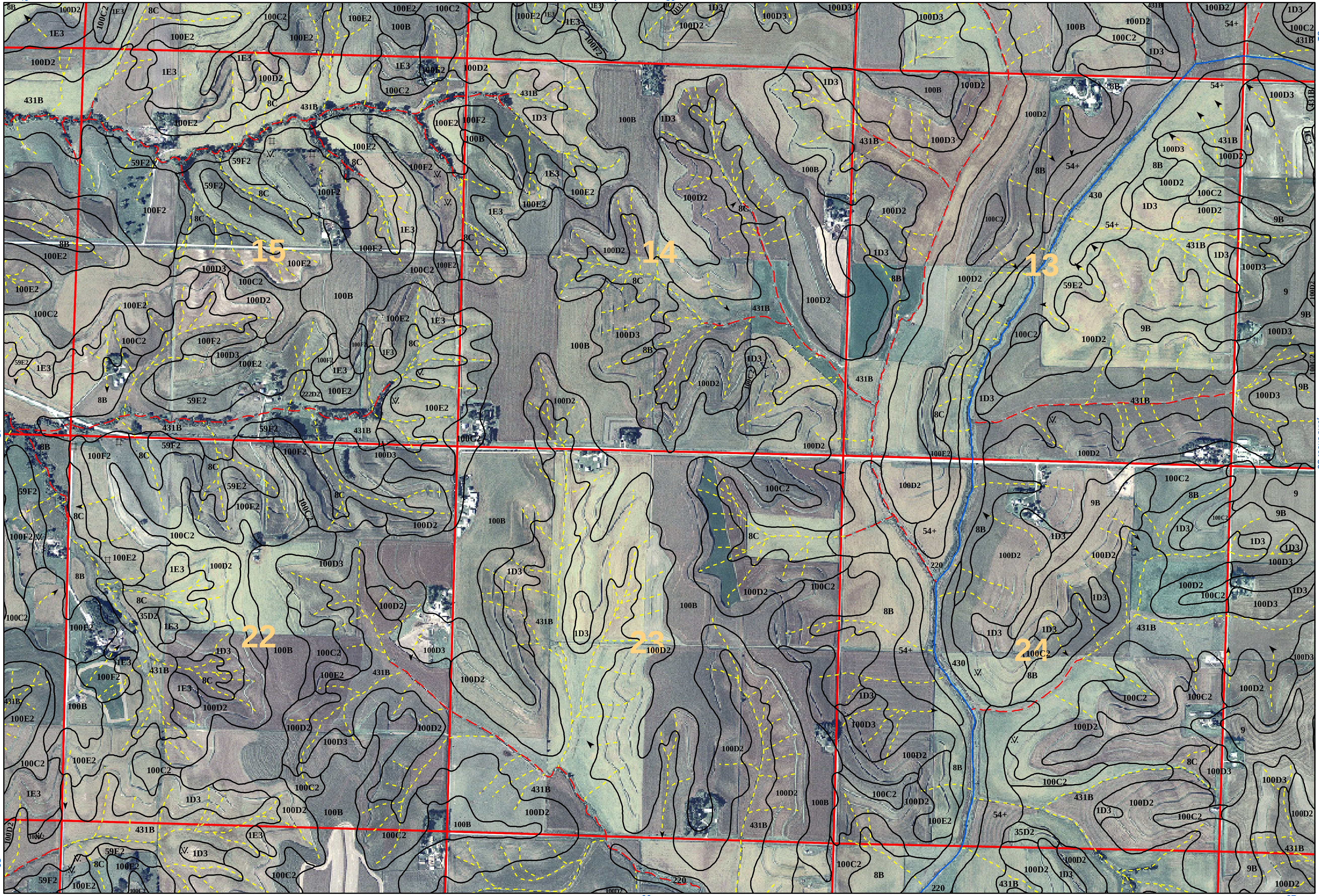
North American Datum of 1983 (NAD83). GRS-80 Spheroid. Universal Transverse Mercator, zone 15.

49
joins sheet 50
51
joins sheet 57
joins sheet 59
65
joins sheet 66
67




N

0 | 1/4 | 1/2 | 3/4 | 1 Miles

0 | 1,000 | 2,000 | 3,000 | 4,000 | 5,000 Feet

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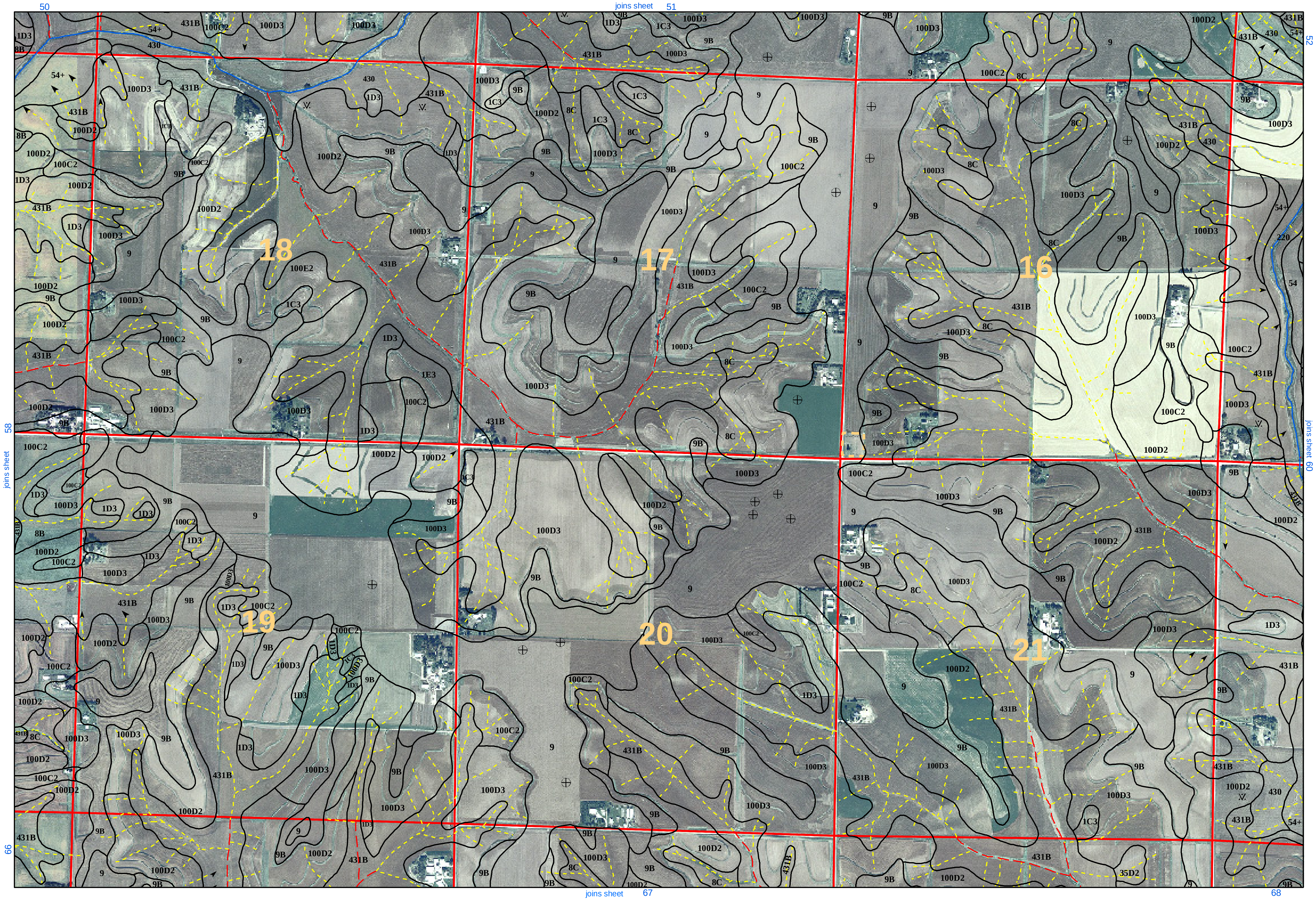
# Township 79N Range 39W



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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

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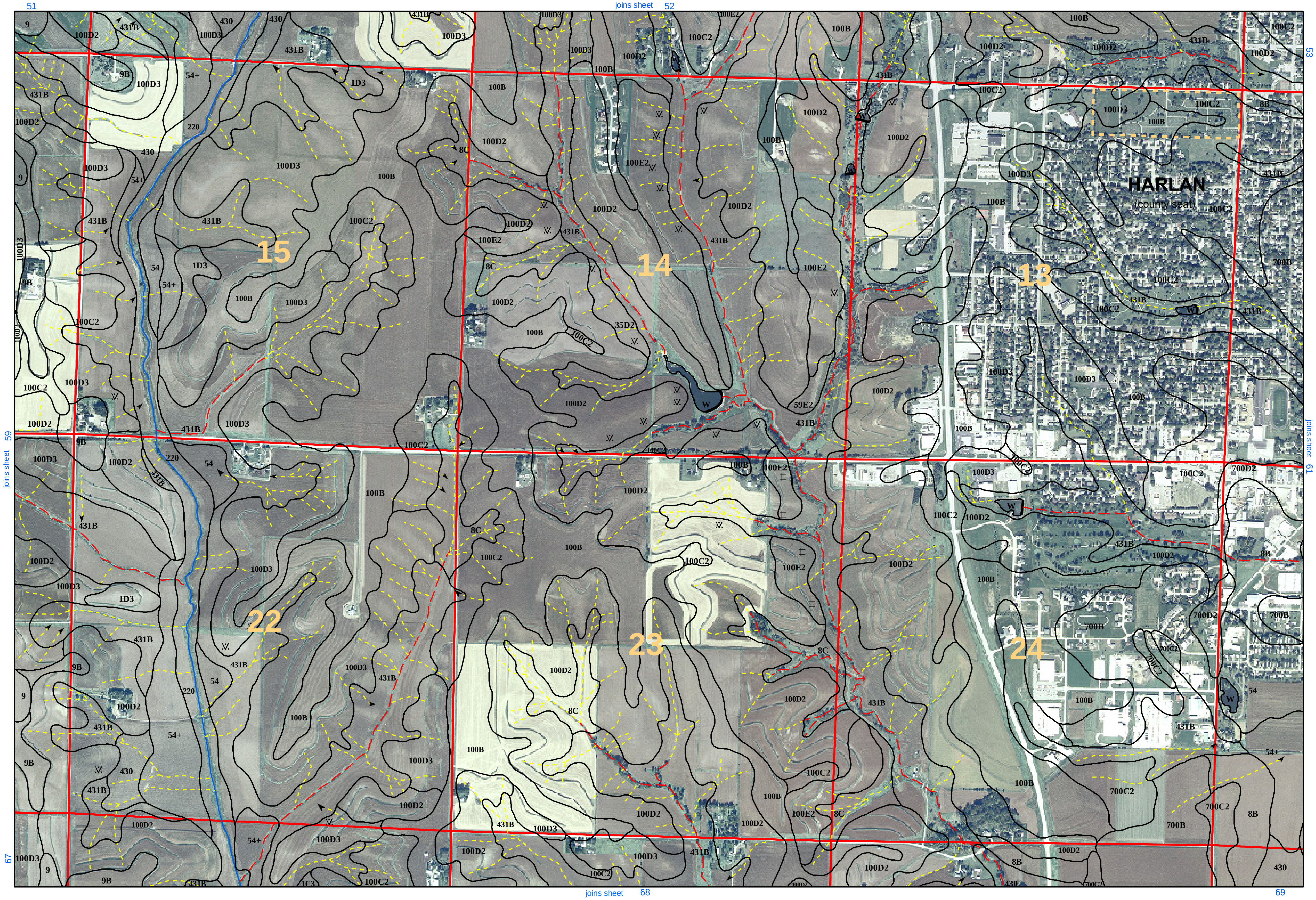
# Township 79N Range 39W



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# Township 79N Range 38W



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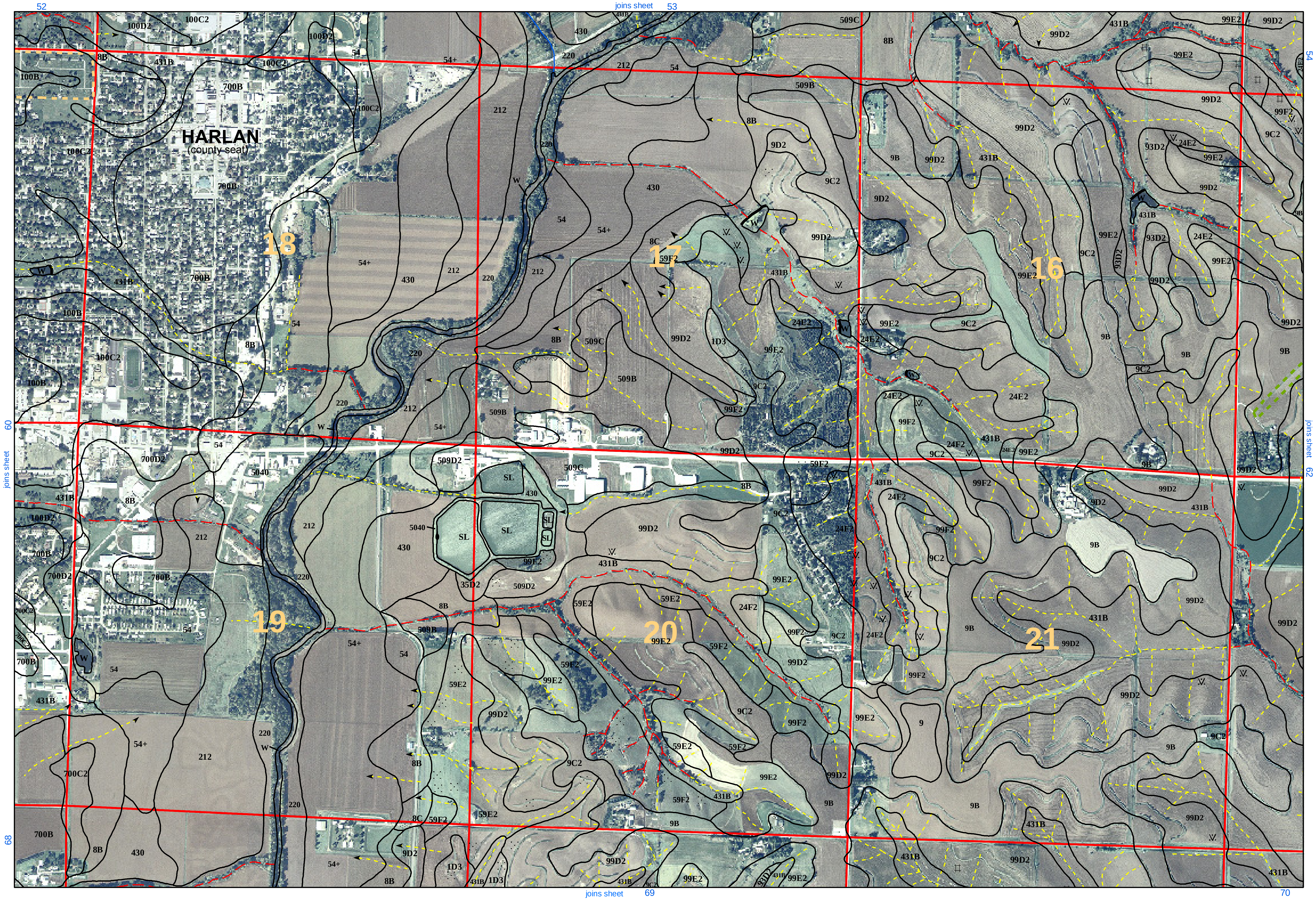


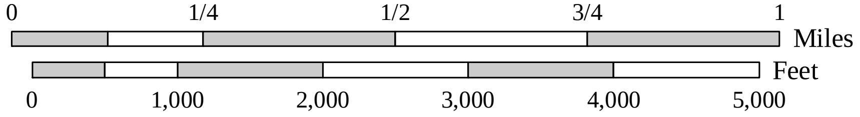


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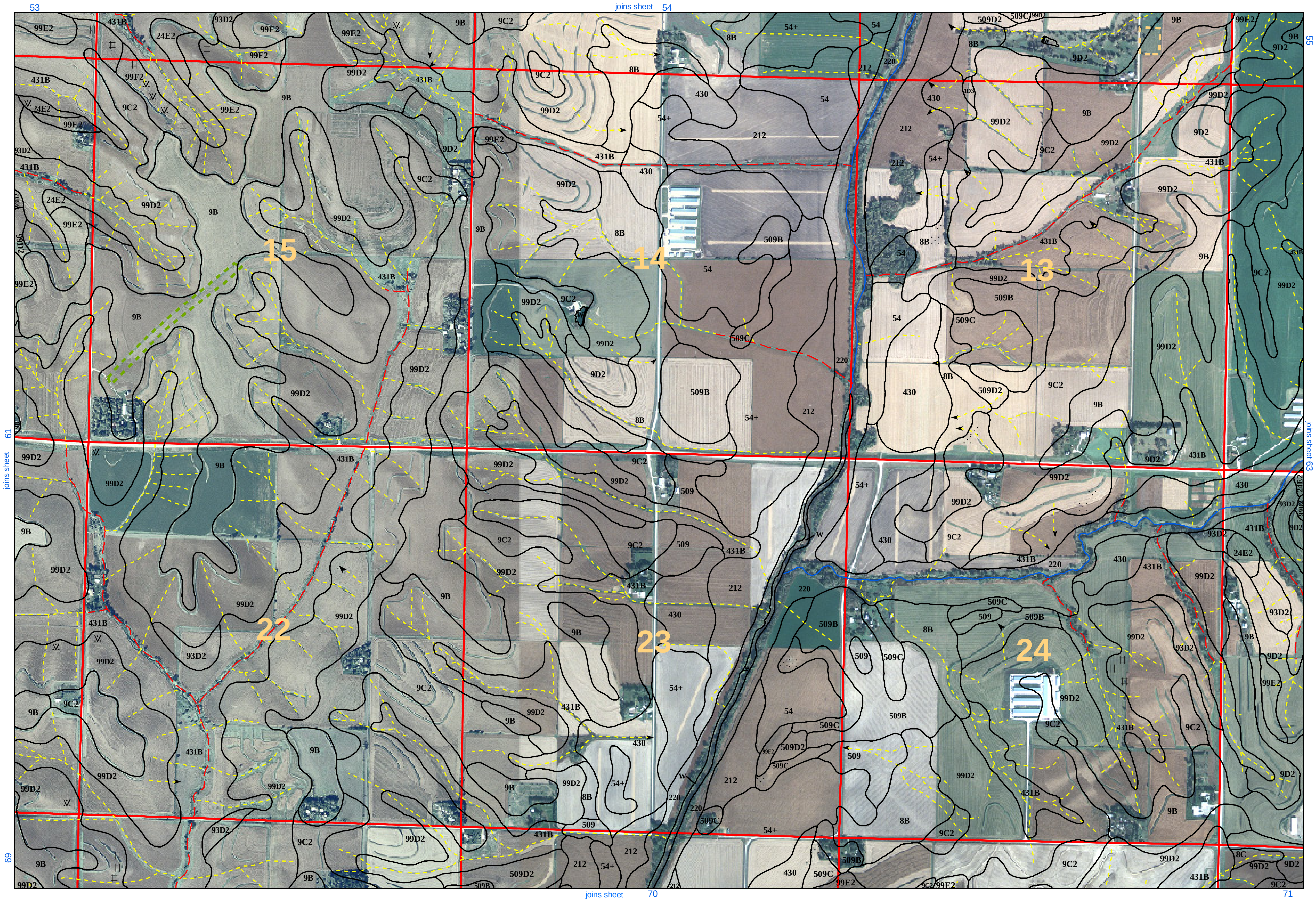
# Township 79N Range 38W



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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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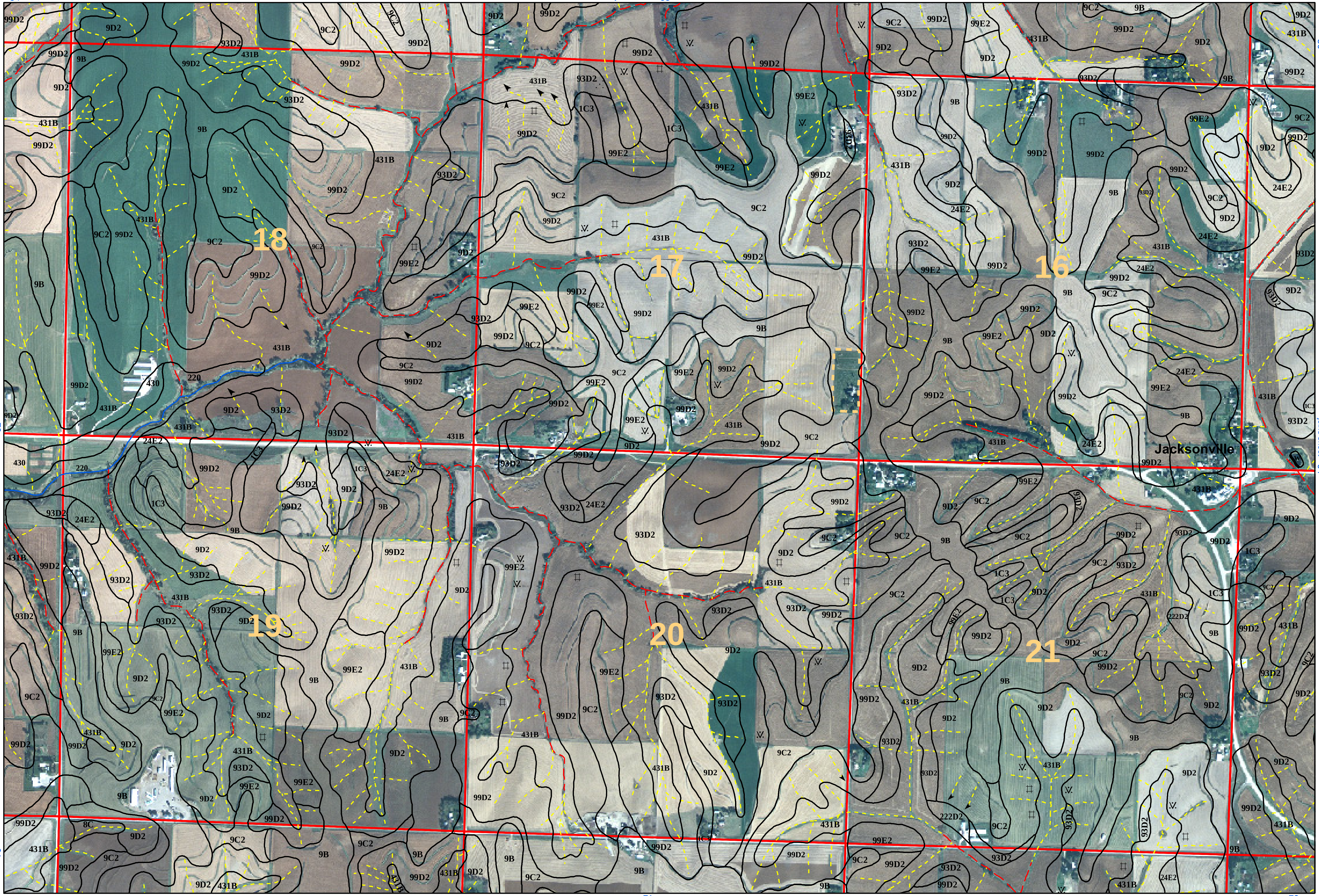
# Township 79N Range 37W

63




Soil Survey of Shelby County, Iowa

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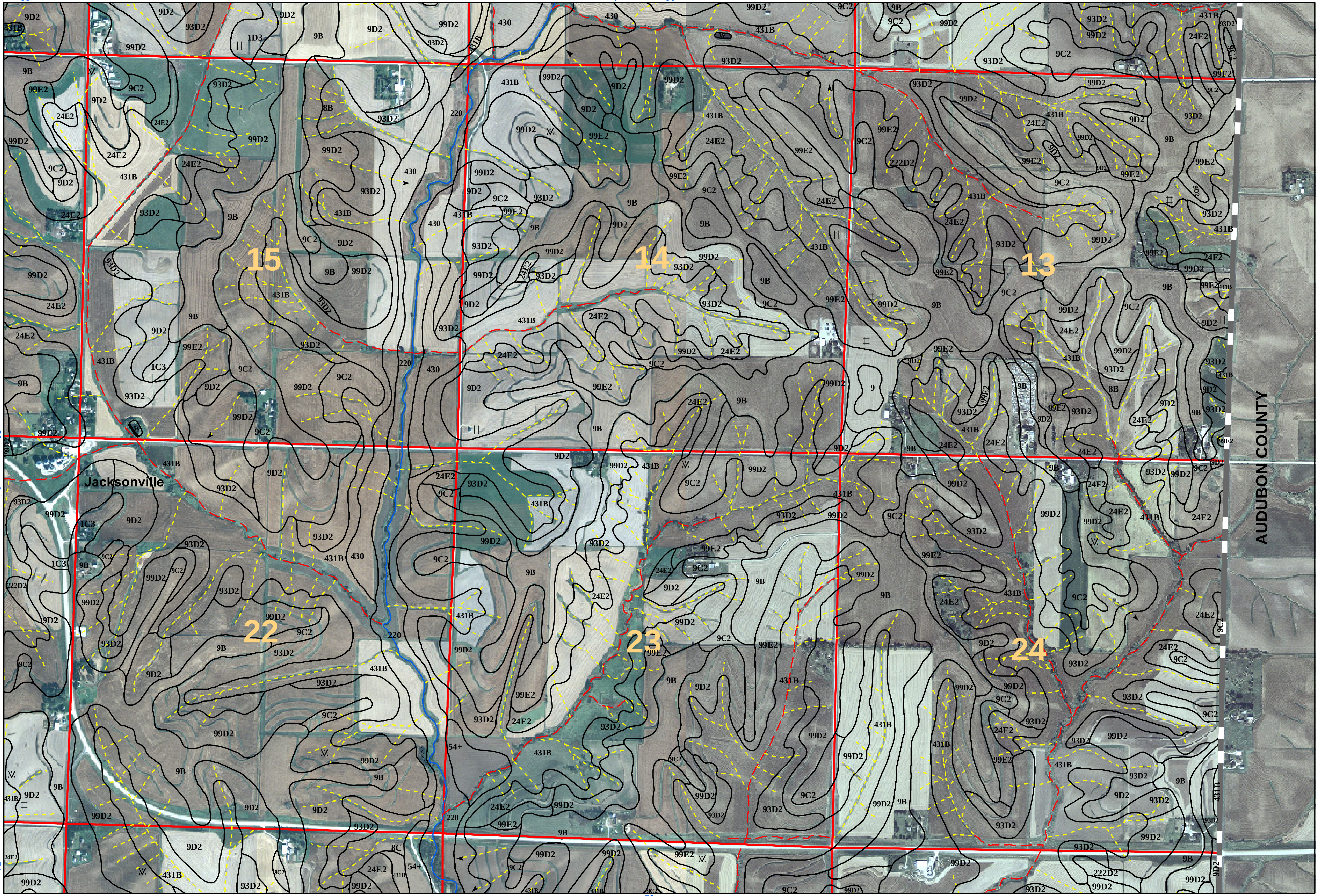
0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 79N Range 37W



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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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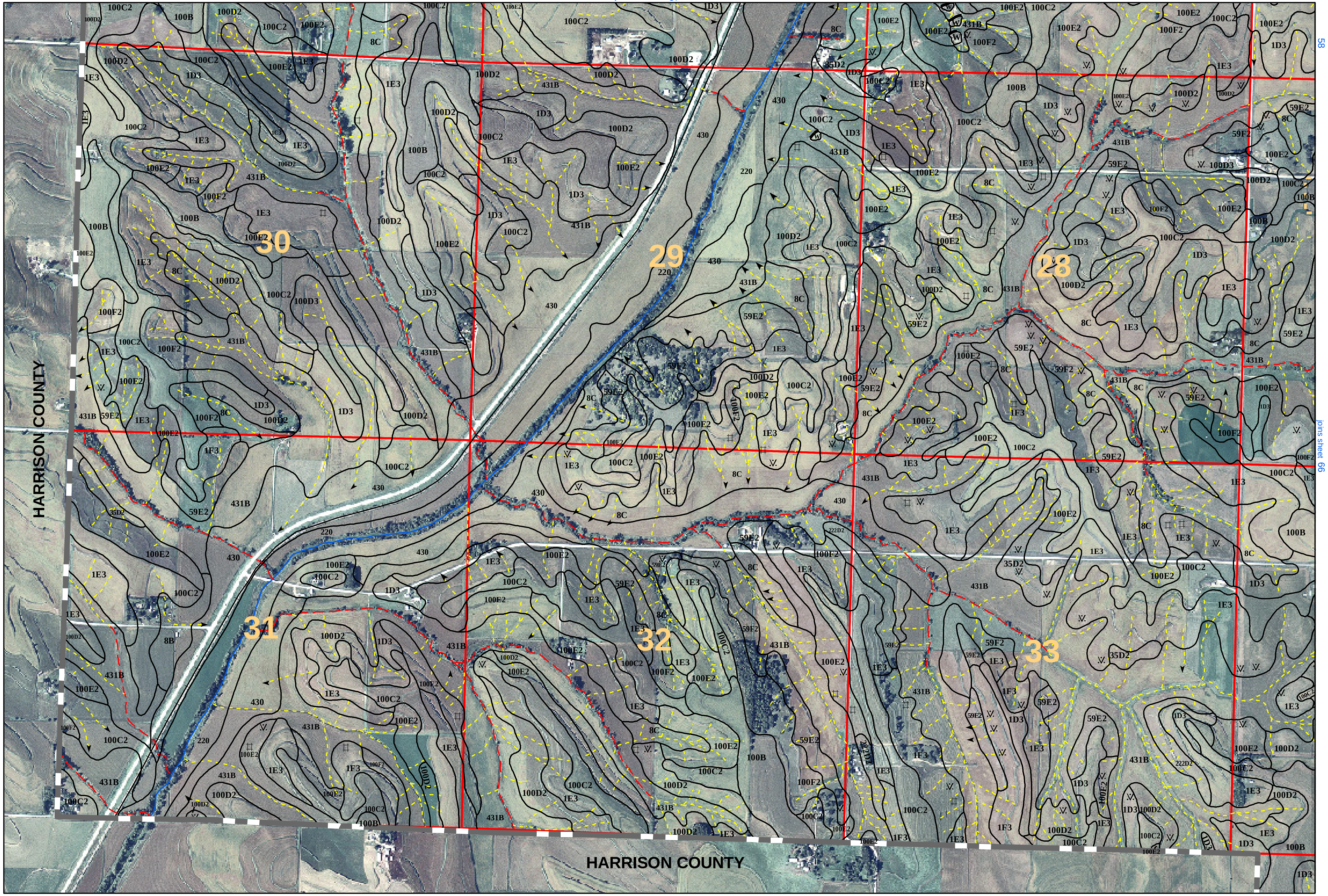
United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 79N Range 40W



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North American Datum of 1983 (NAD83). GRS-80 Spheroid. Universal Transverse Mercator, zone 15.

N

0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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United States Department of Agriculture
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66

# Township 79N Range 40W

66

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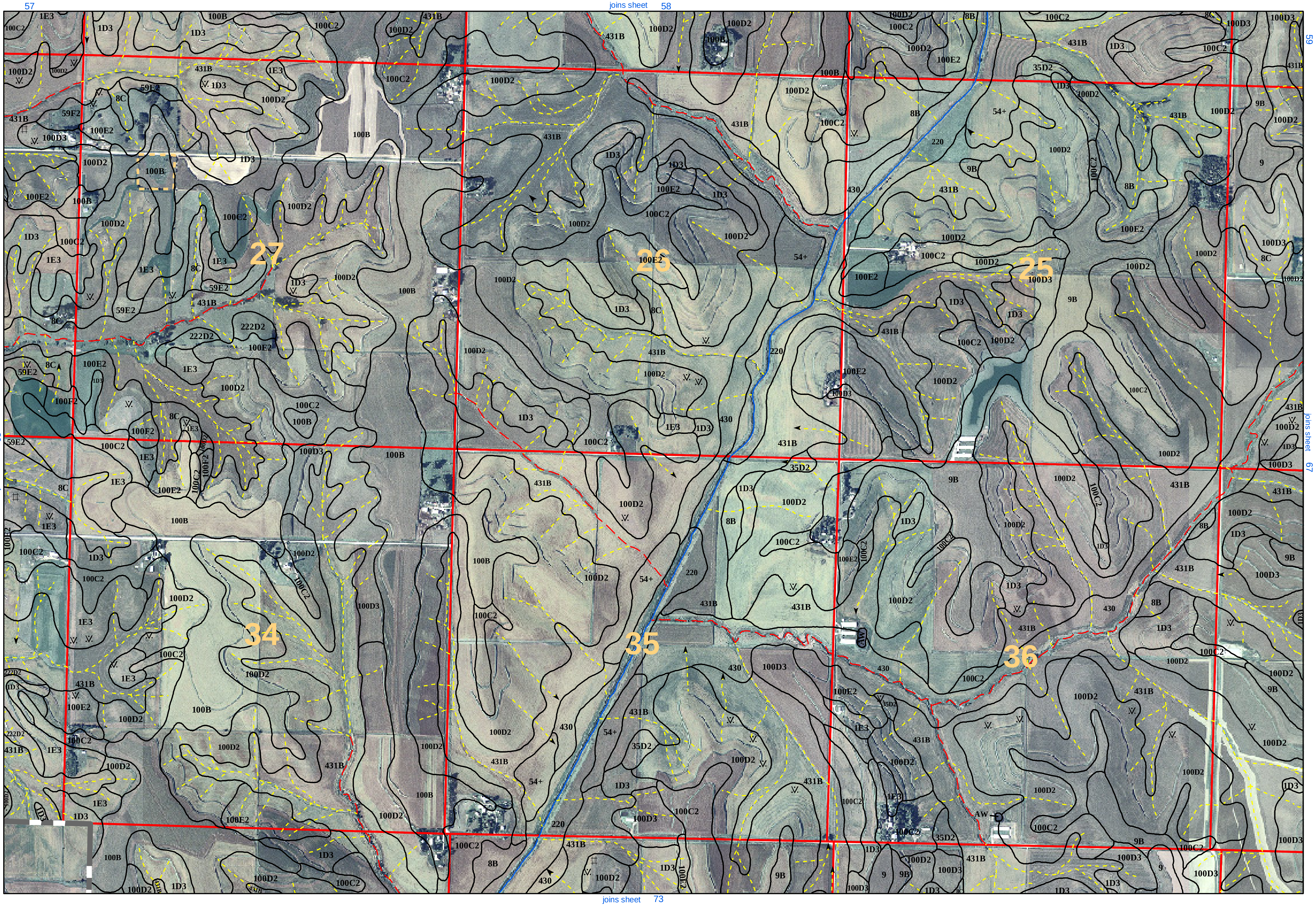


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

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United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 79N Range 39W

67

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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

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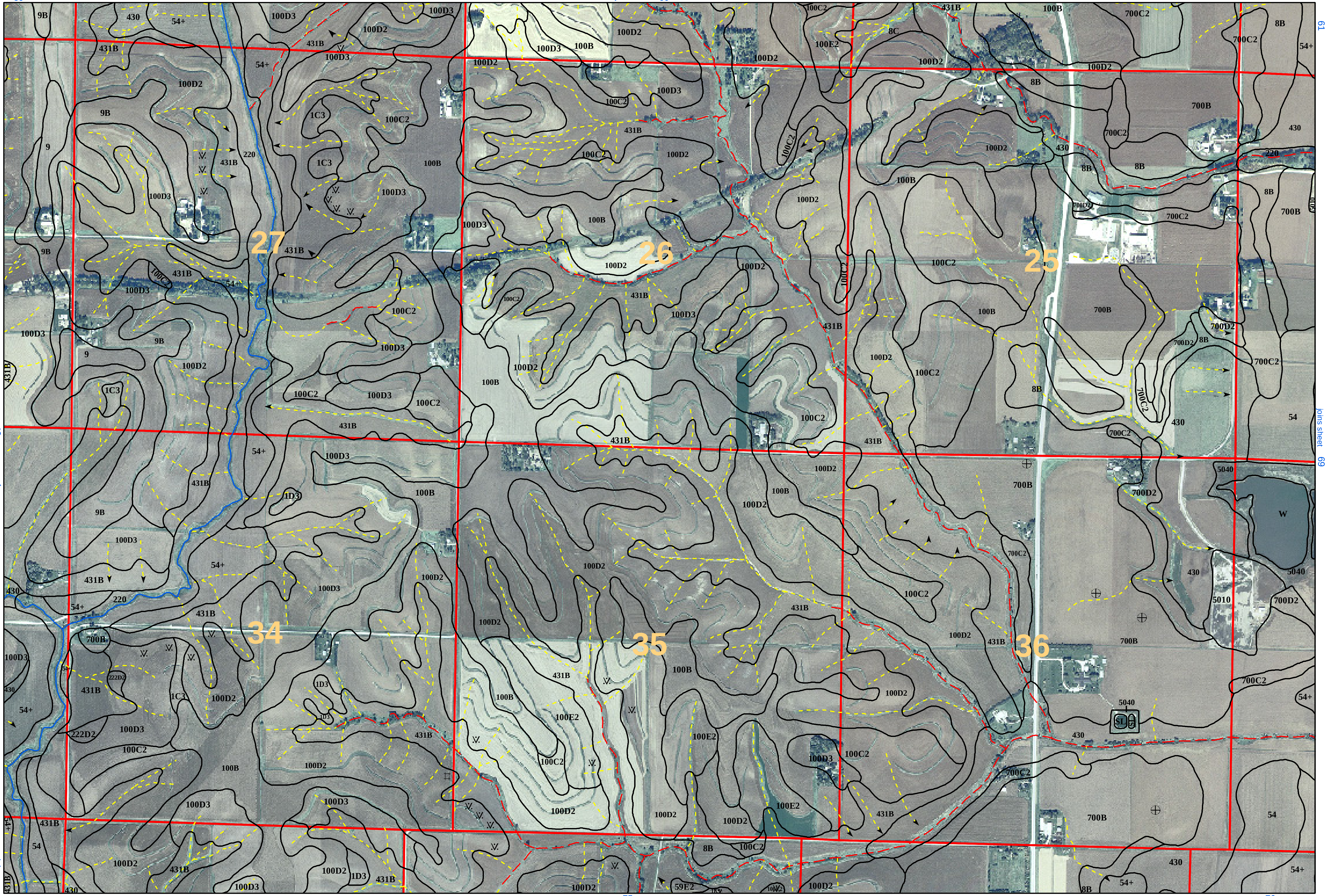
United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 79N Range 39W



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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 79N Range 38W



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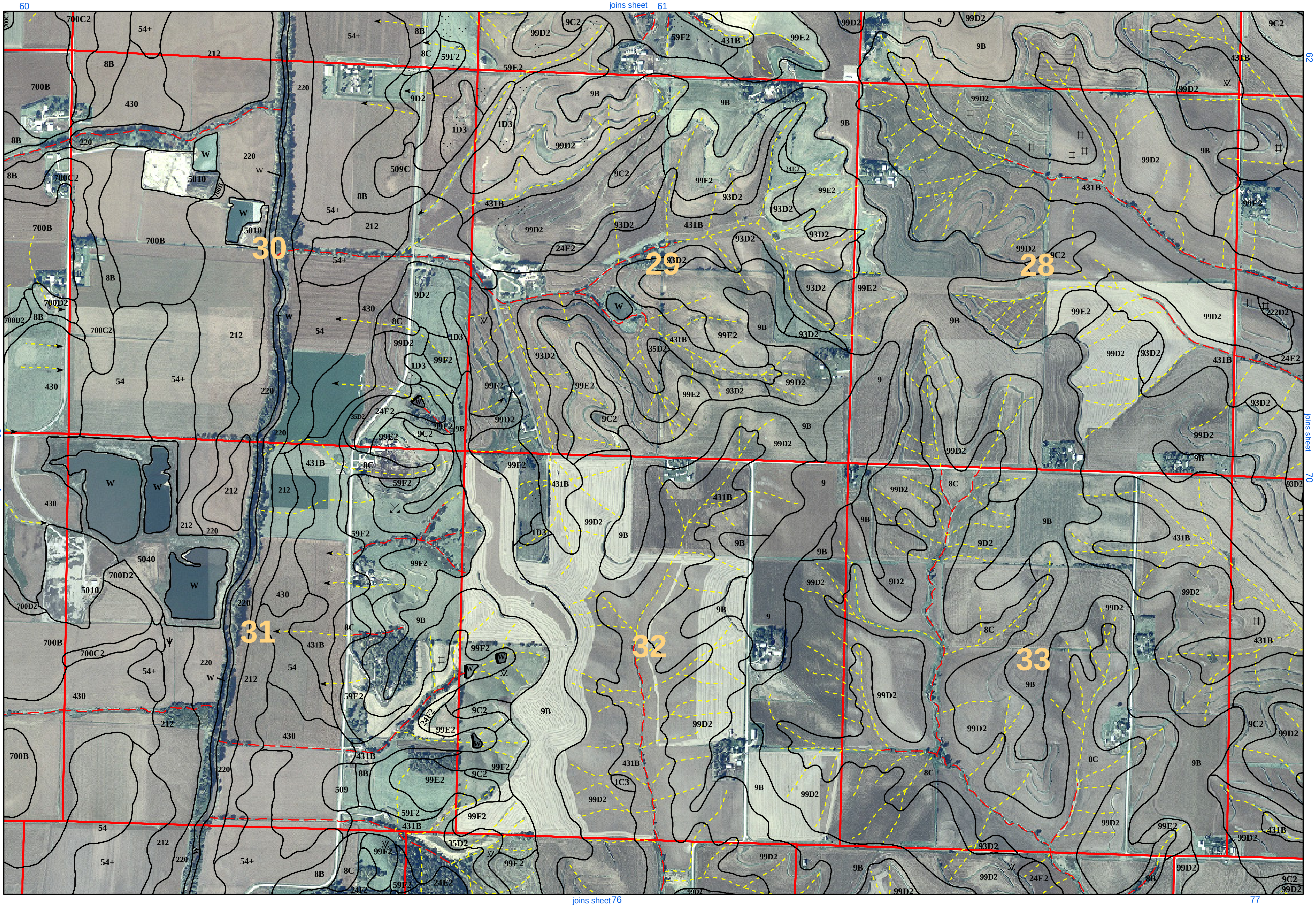


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 79N Range 38W

70


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0 1/4 1/2 3/4 1 Miles

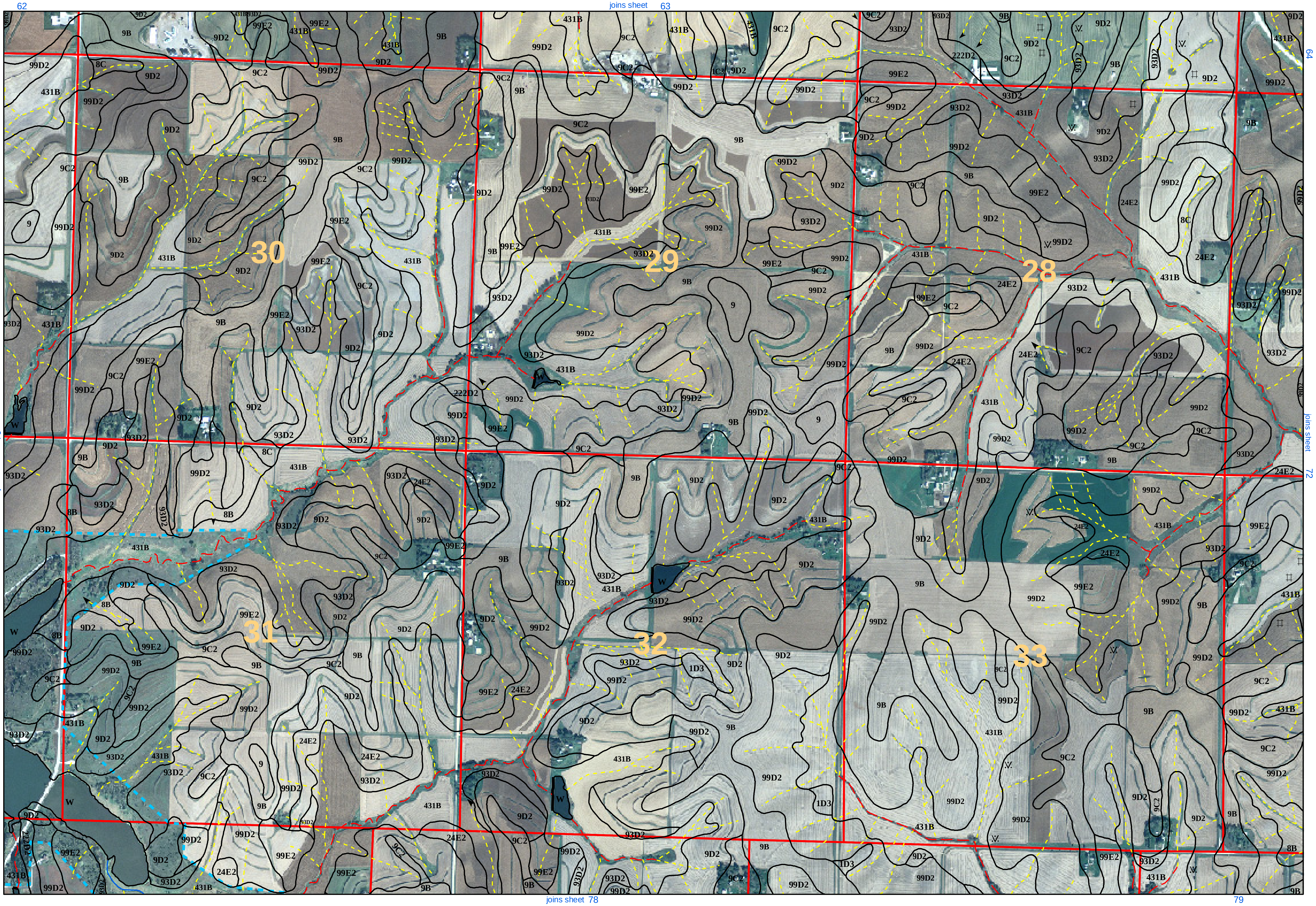
0 1,000 2,000 3,000 4,000 5,000 Feet

United States Department of Agriculture
NRCS Natural Resources Conservation Service

71

# Township 79N Range 37W

71

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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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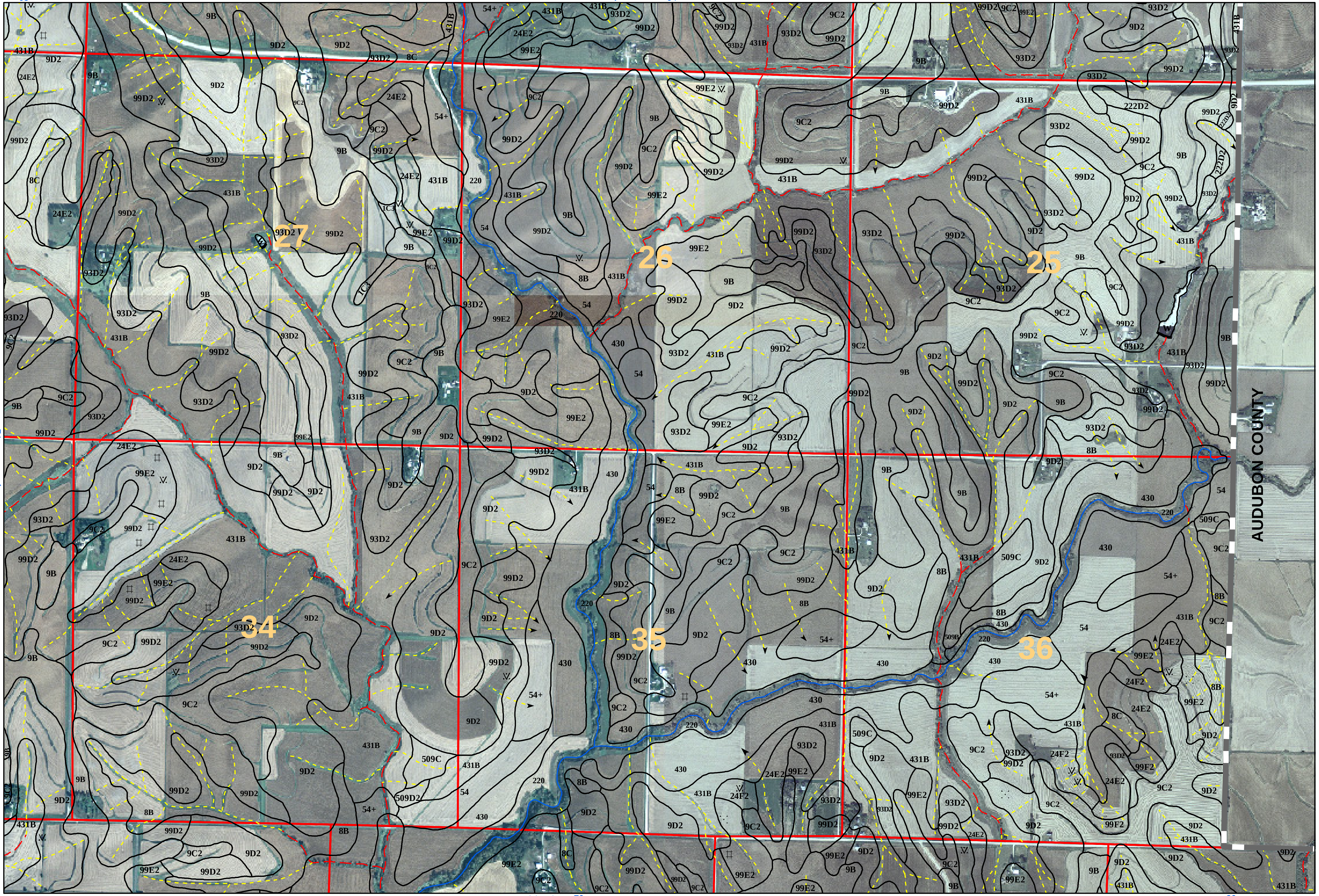
# Township 79N Range 37W

72

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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 78N Range 40W

73

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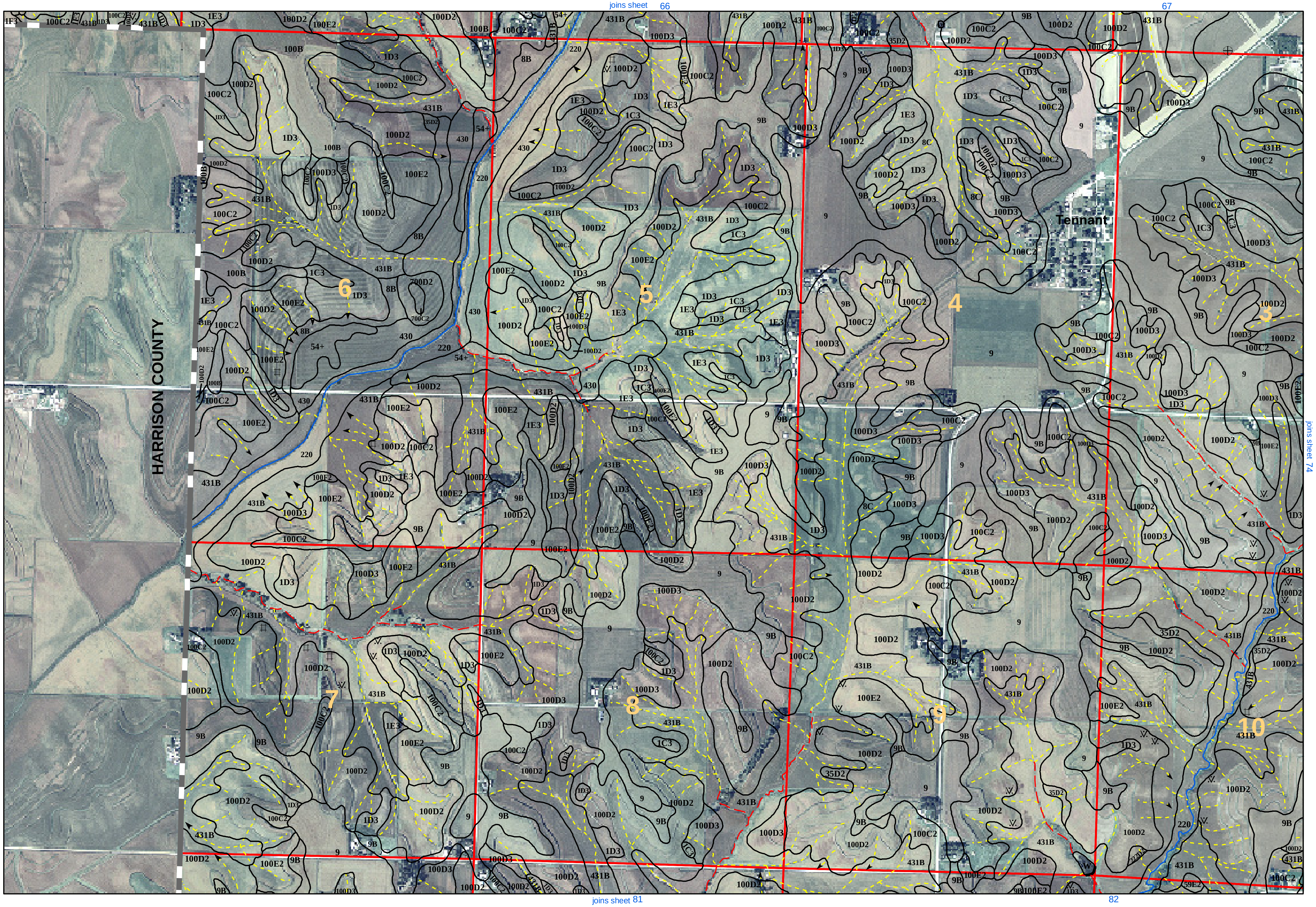


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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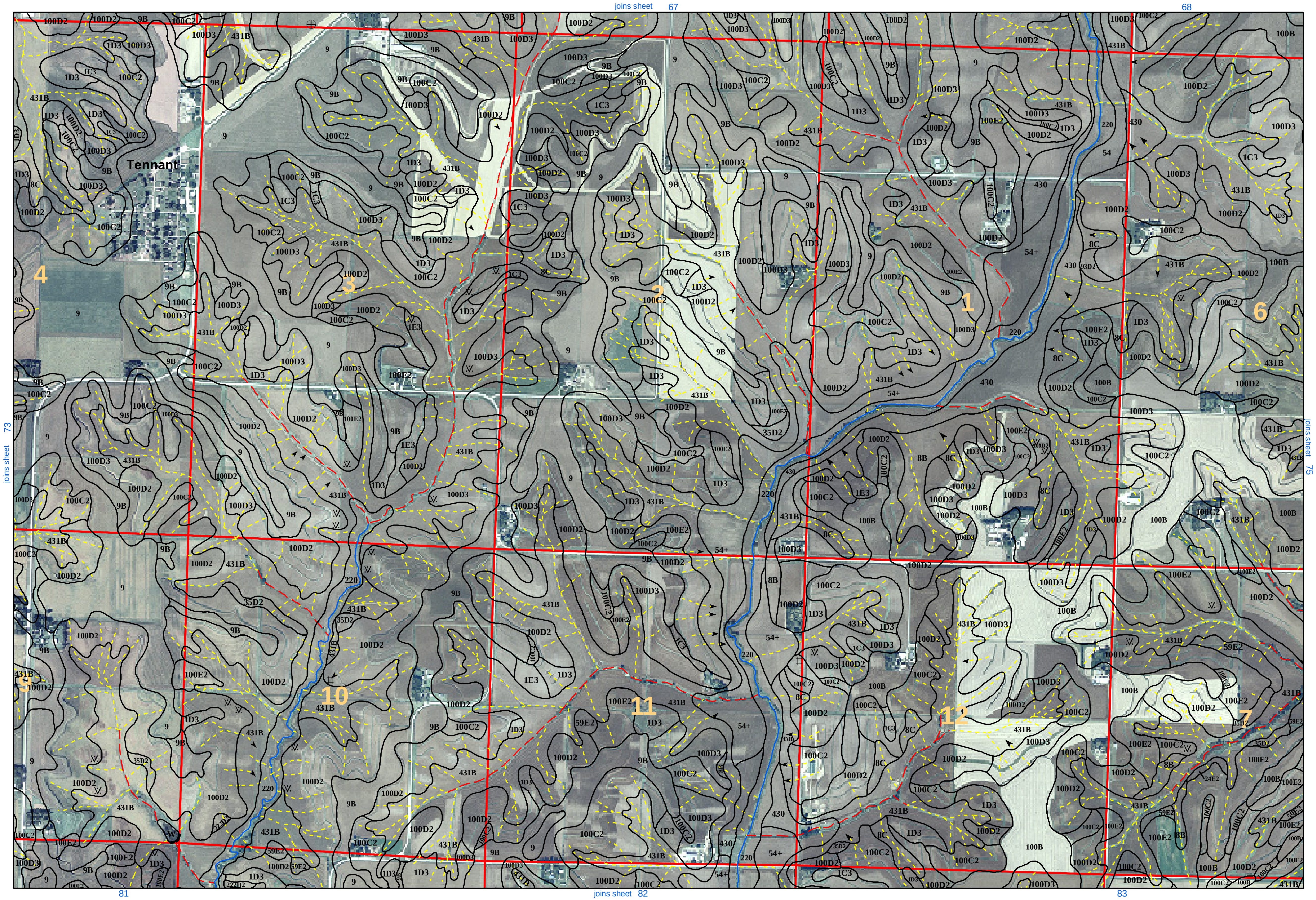
United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 78N Range 40W

74

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N

0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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United States Department of Agriculture
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# Township 78N Range 39W



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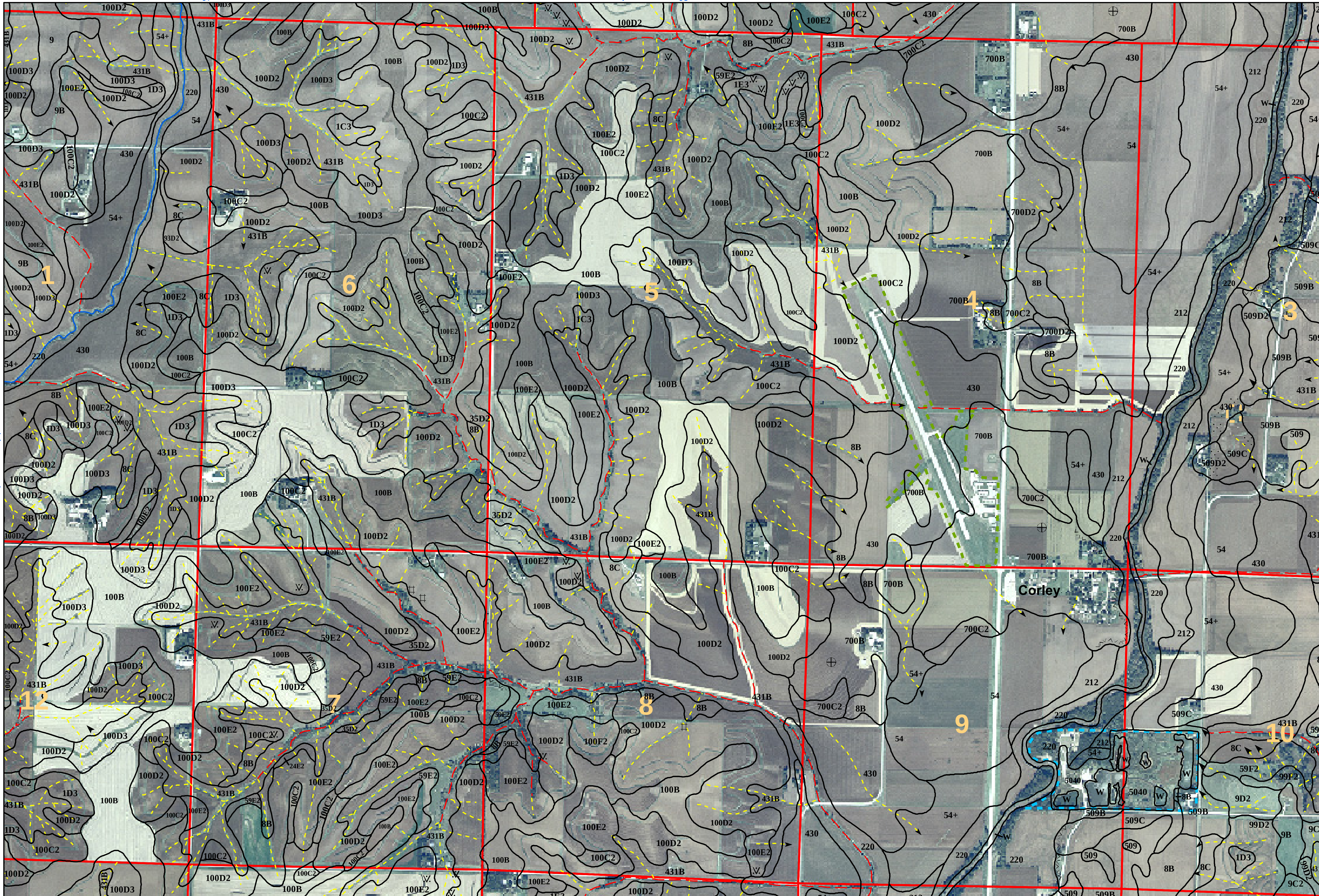
North American Datum of 1983 (NAD83). GRS-80 Spheroid. Universal Transverse Mercator, zone 15.

67 joins sheet 68

joins sheet 74




joins sheet 76

82 joins sheet 83 84

0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 78N Range 39W

76

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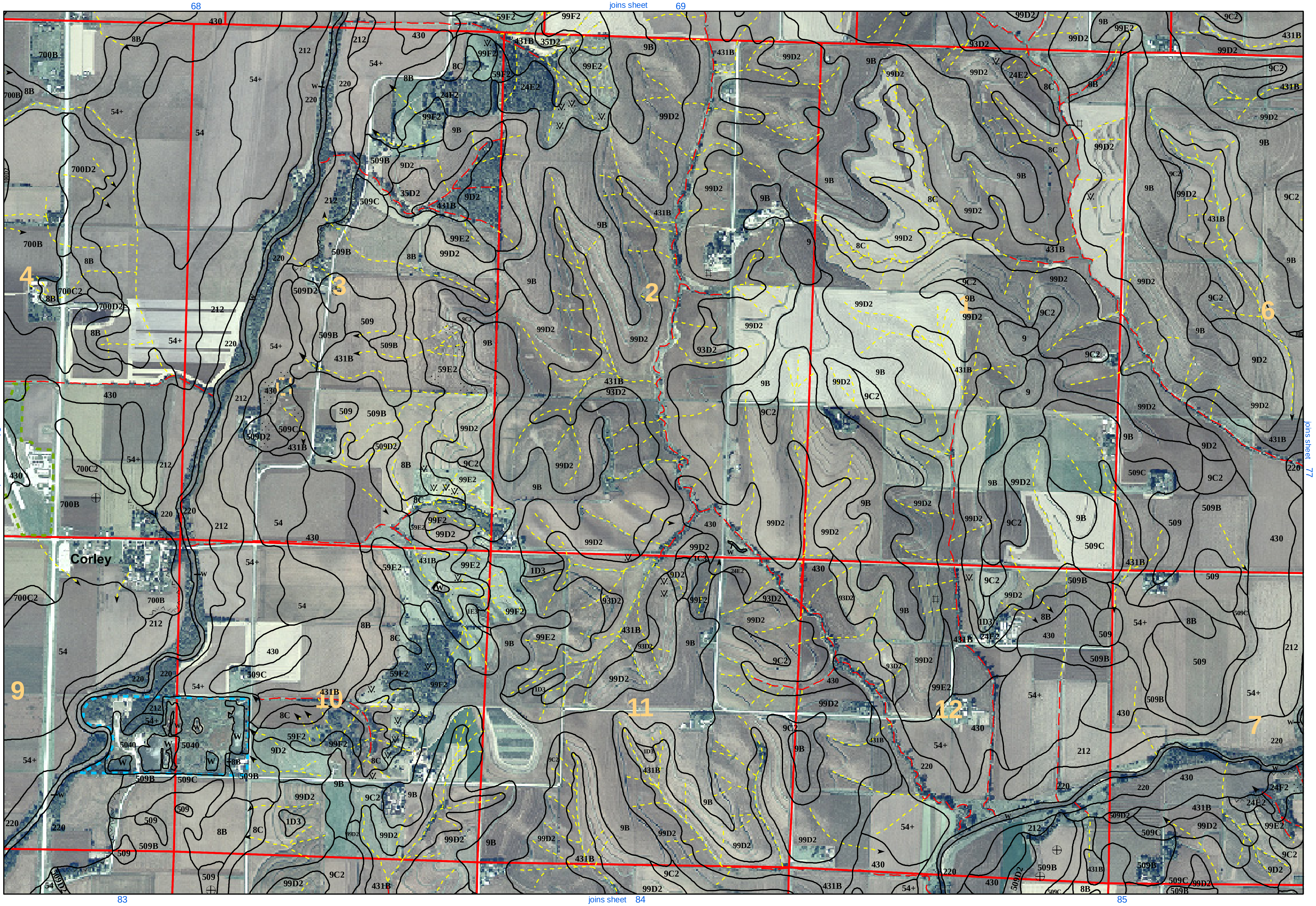


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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United States Department of Agriculture
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# Township 78N Range 38W



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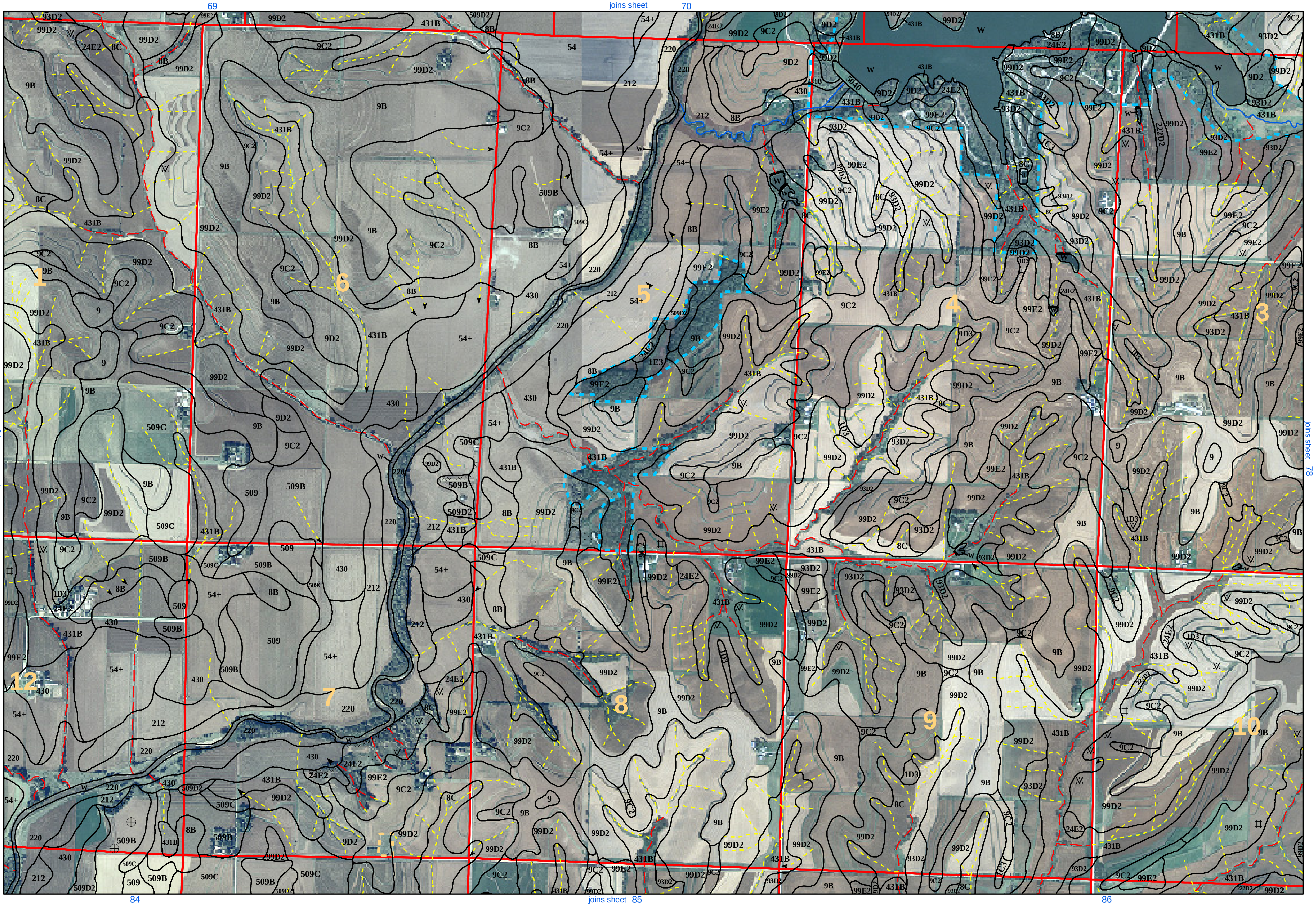


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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United States Department of Agriculture
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# Township 78N Range 38W

78

78

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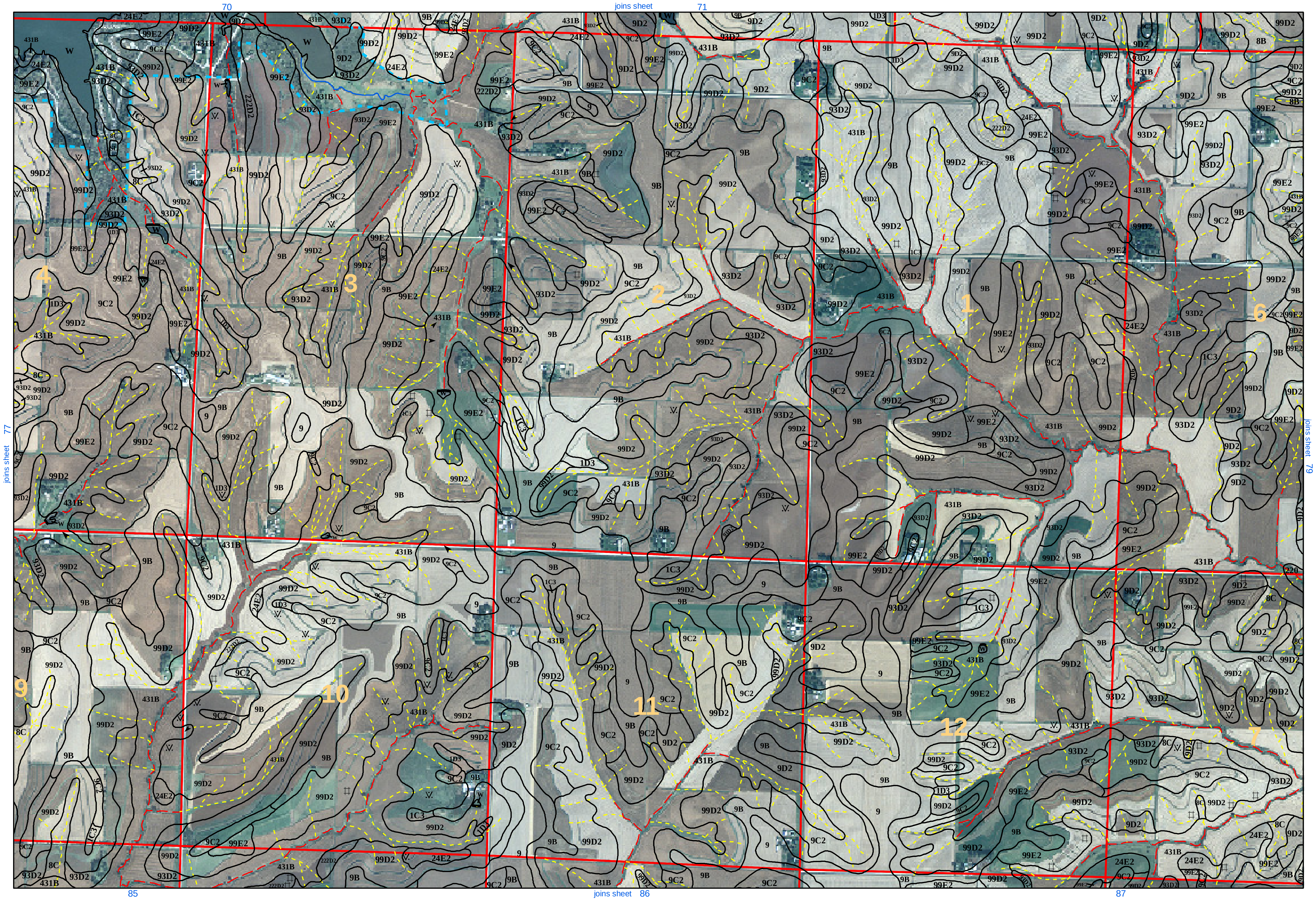


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

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# Township 78N Range 37W

79

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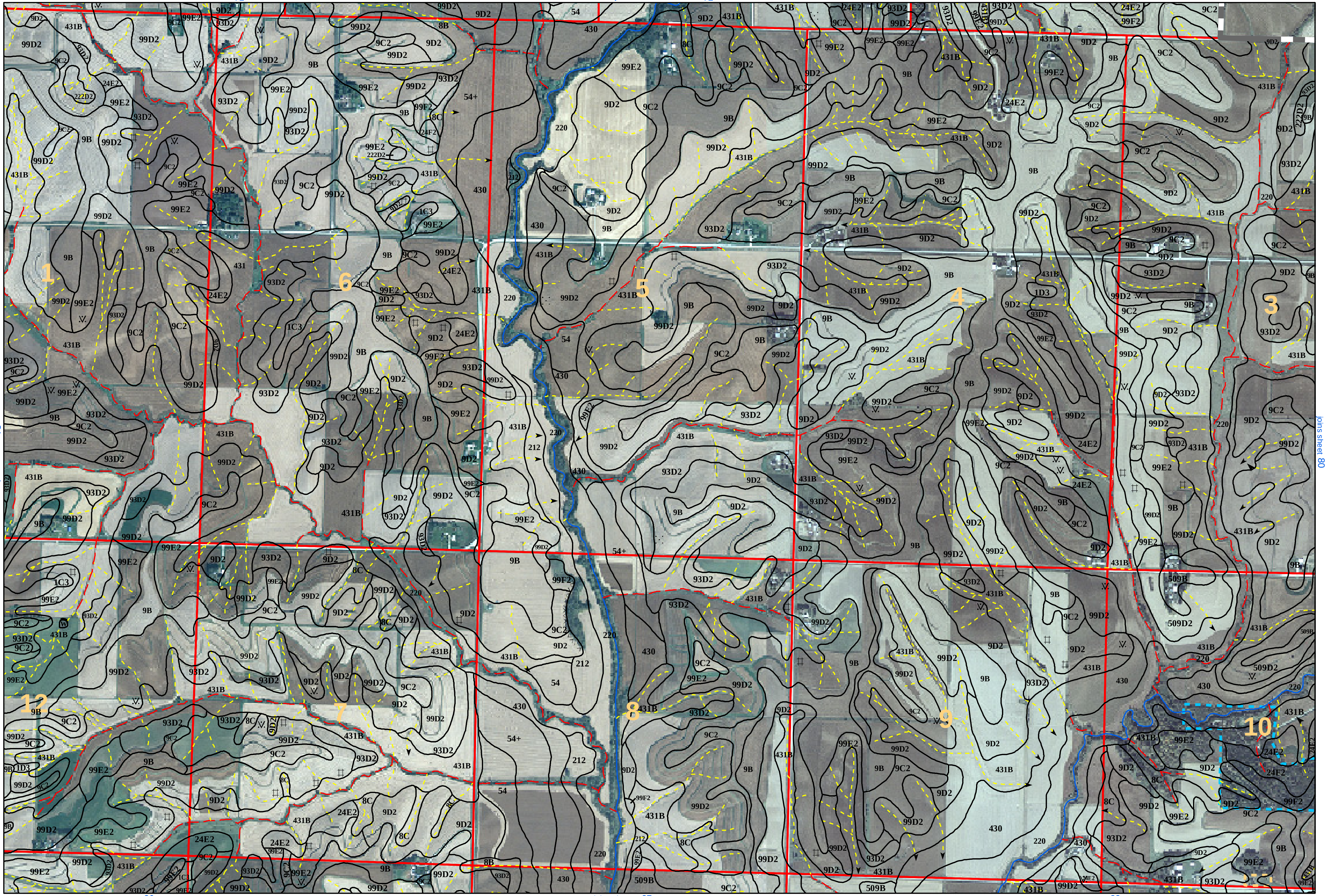


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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 78N Range 37W

80

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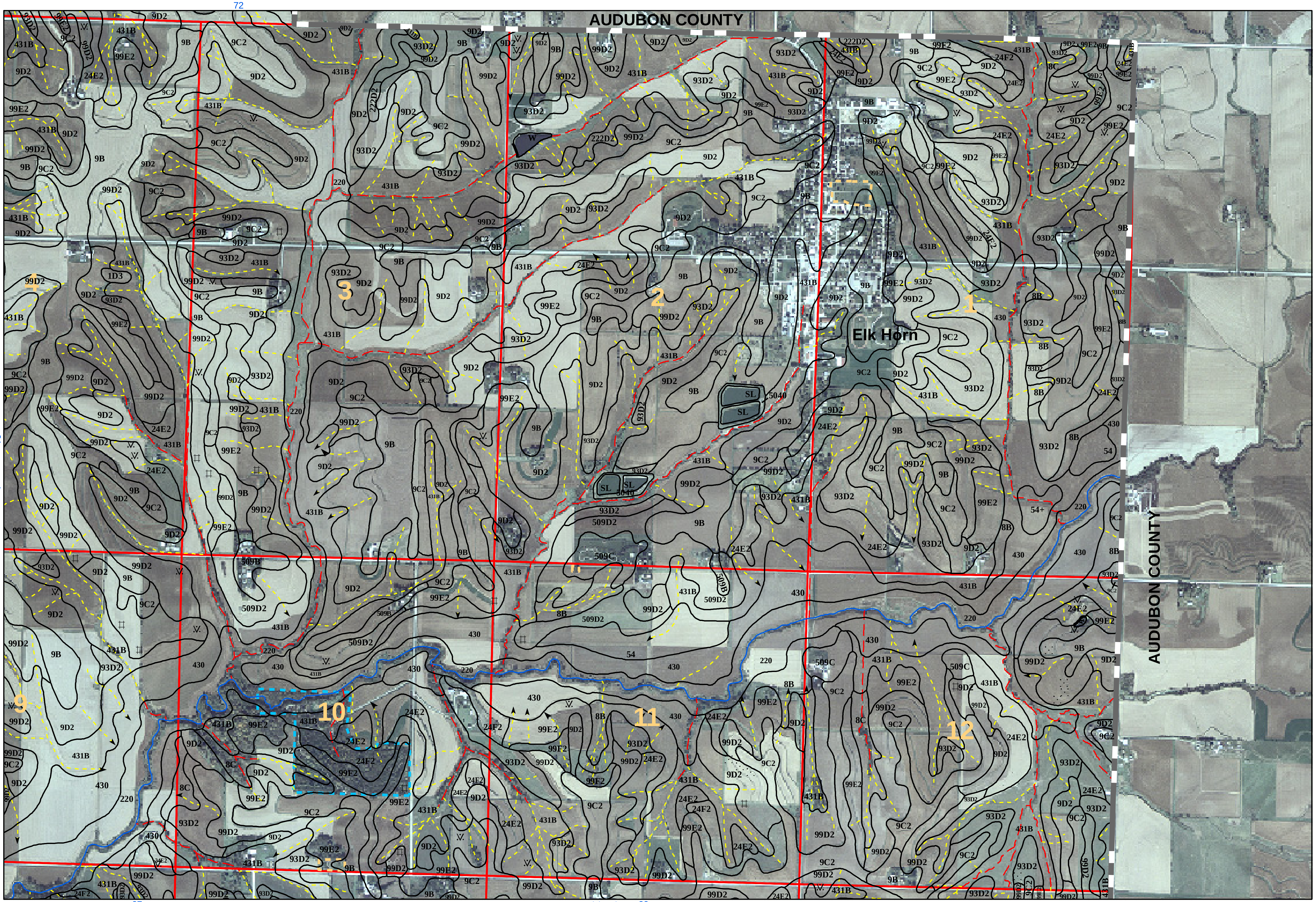
North American Datum of 1983 (NAD83). GRS-80 Spheroid. Universal Transverse Mercator, zone 15.

72

joins sheet 79




87

joins sheet 88

0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

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United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 78N Range 40W



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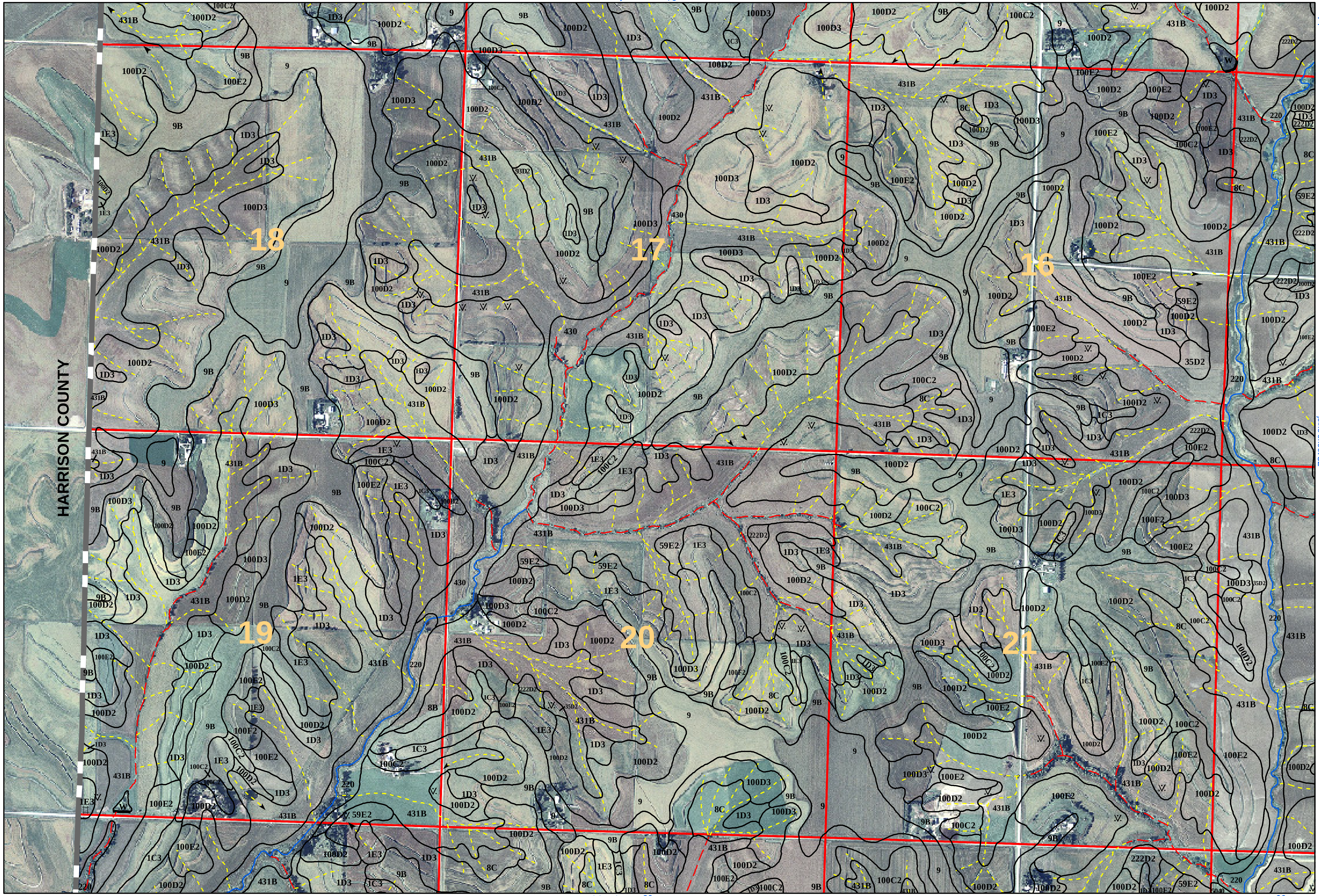
North American Datum of 1983 (NAD83). GRS-80 Spheroid. Universal Transverse Mercator, zone 15.

joins sheet 73




joins sheet 89

90

0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 78N Range 40W



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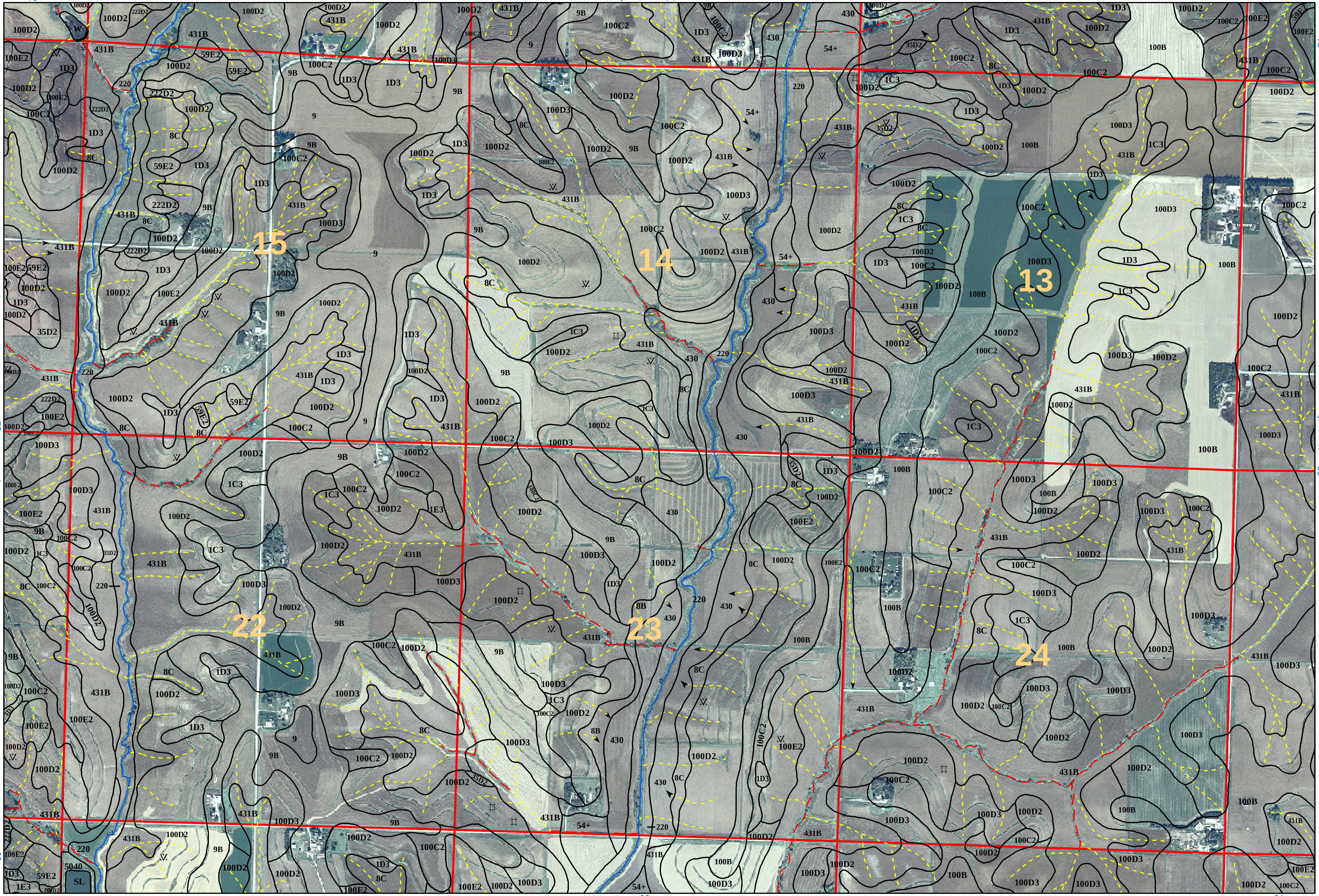
73 joins sheet 74 75
81 joins sheet
joins sheet 83
89 joins sheet 90 91




0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 78N Range 39W

83

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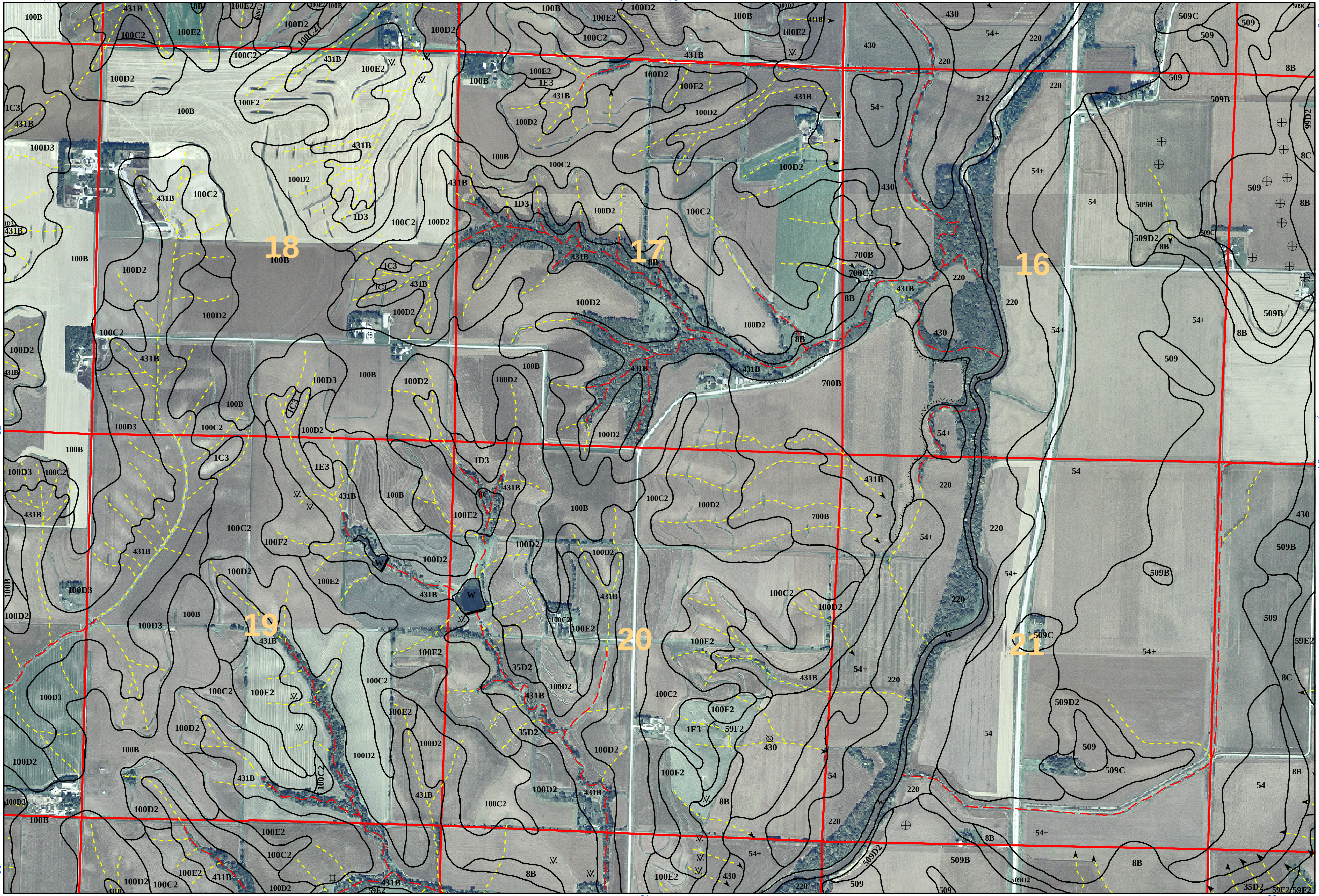


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0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

United States Department of Agriculture
NRCS Natural Resources Conservation Service

# Township 78N Range 39W



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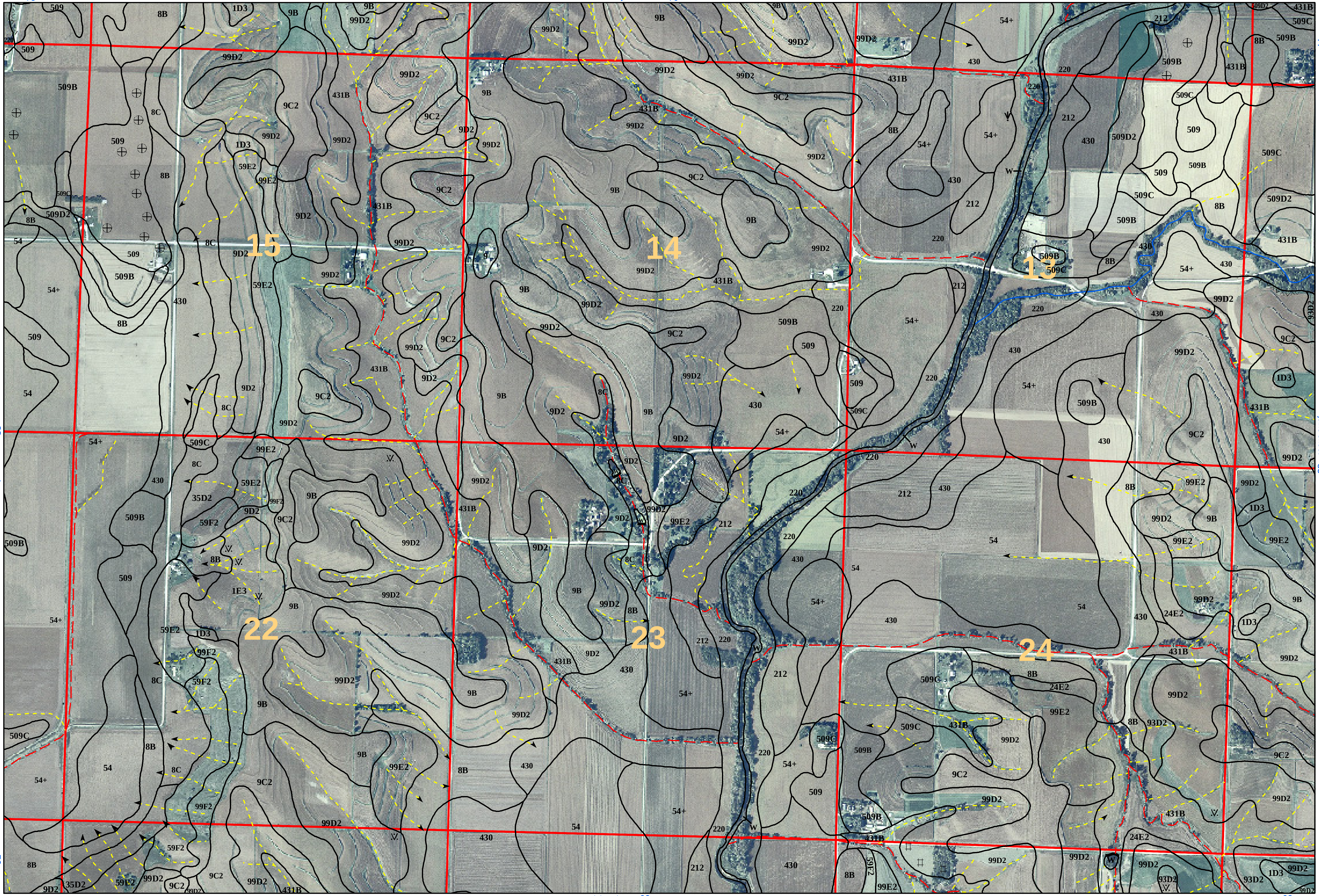


0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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# Township 78N Range 38W



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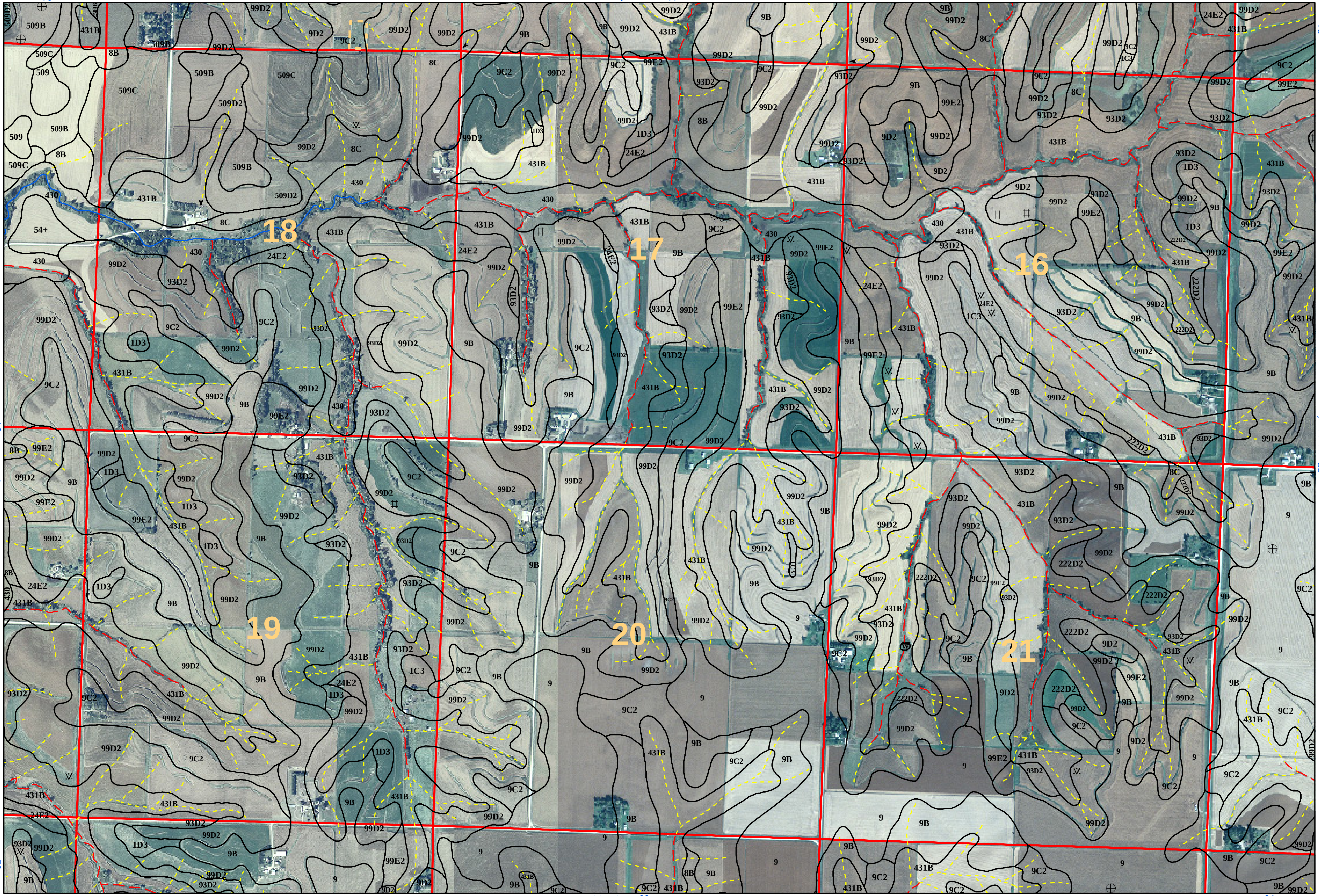
76 joins sheet 77 78




joins sheet 84 joins sheet 86

92 joins sheet 93 94

0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

N

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United States Department of Agriculture
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# Township 78N Range 38W



## Soil Survey of Shelby County, Iowa

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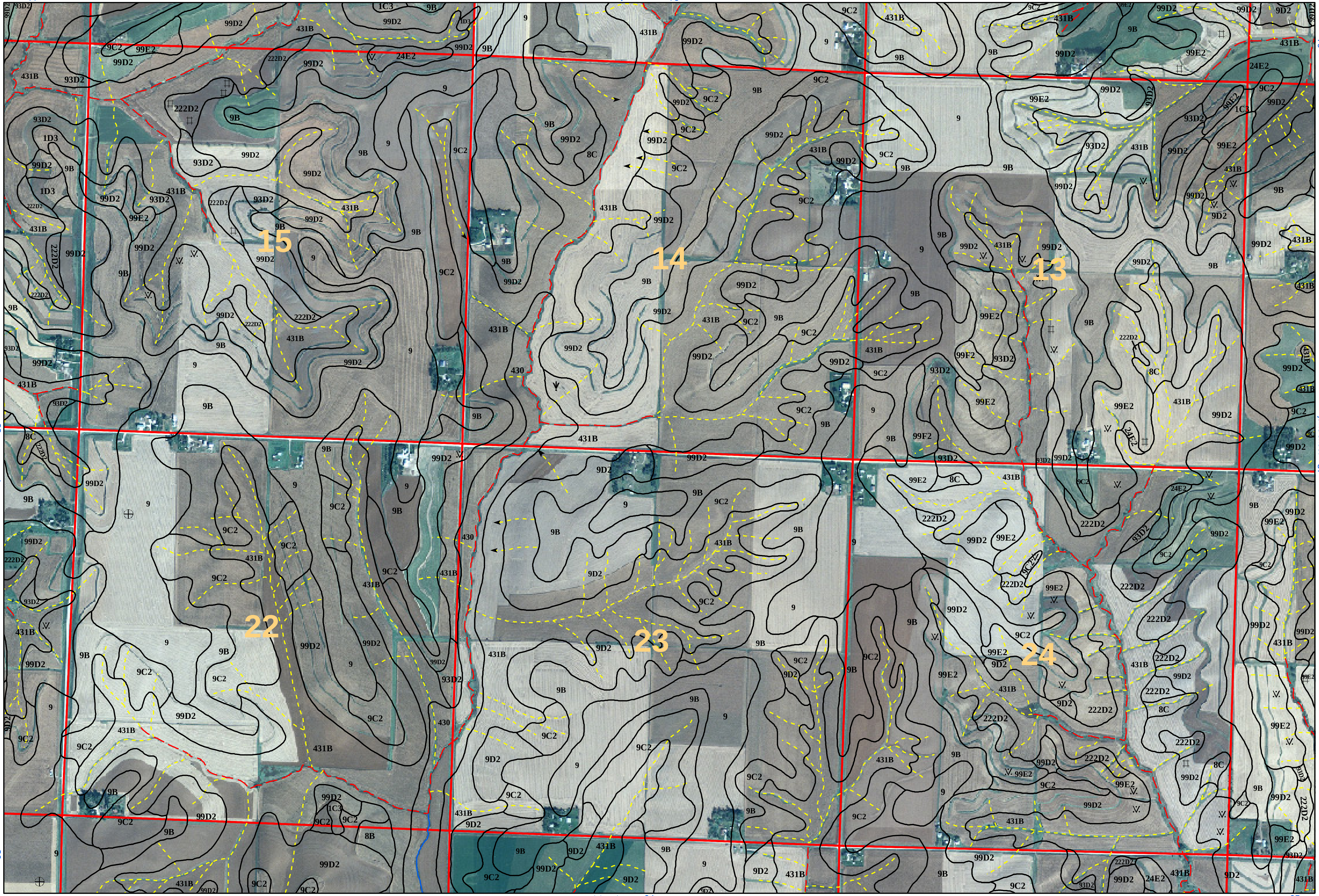
North American Datum of 1983 (NAD83). GRS-80 Spheroid. Universal Transverse Mercator, zone 15.




0 1/4 1/2 3/4 1 Miles

0 1,000 2,000 3,000 4,000 5,000 Feet

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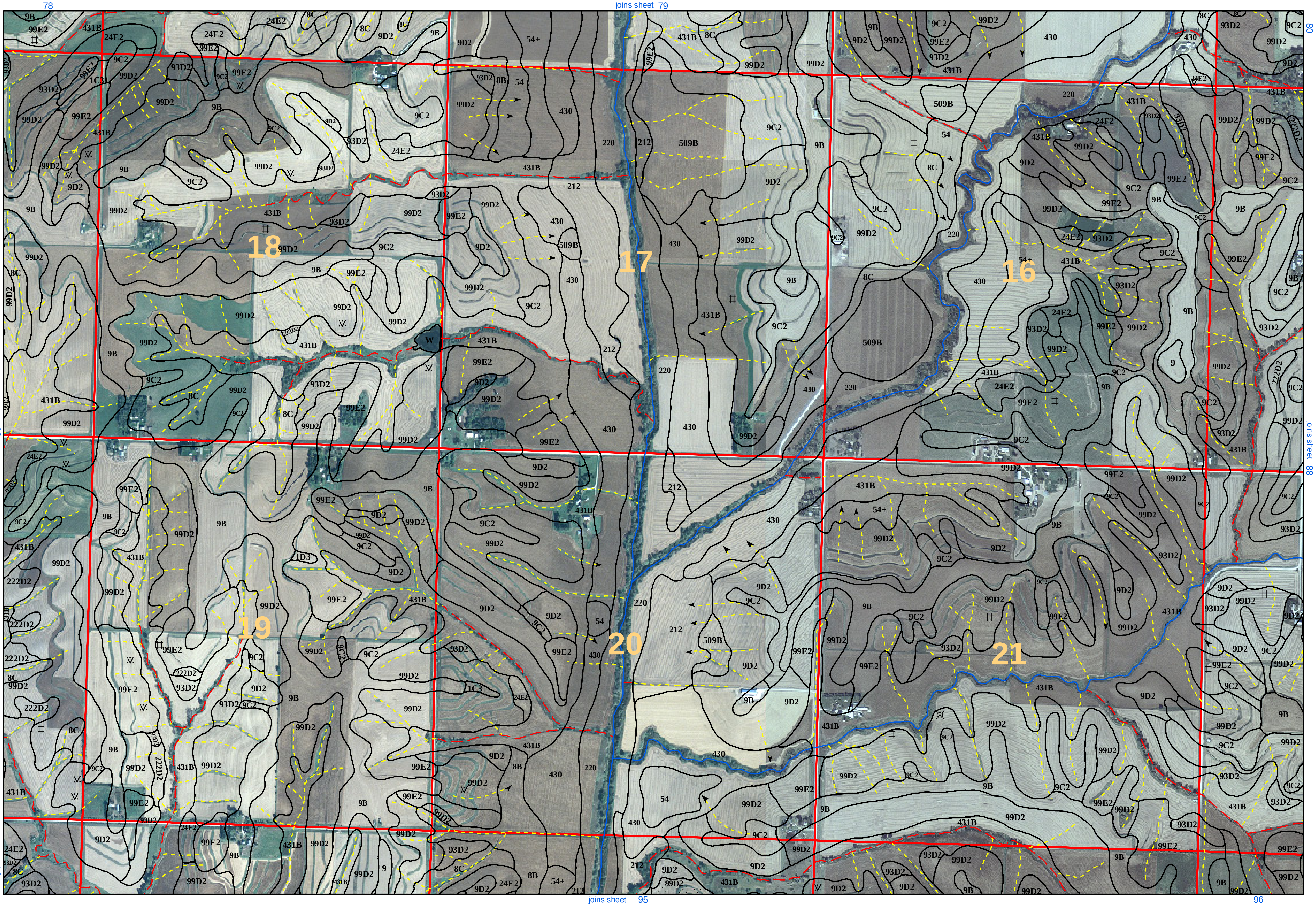
# Township 78N Range 37W



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# Township 78N Range 37W

88

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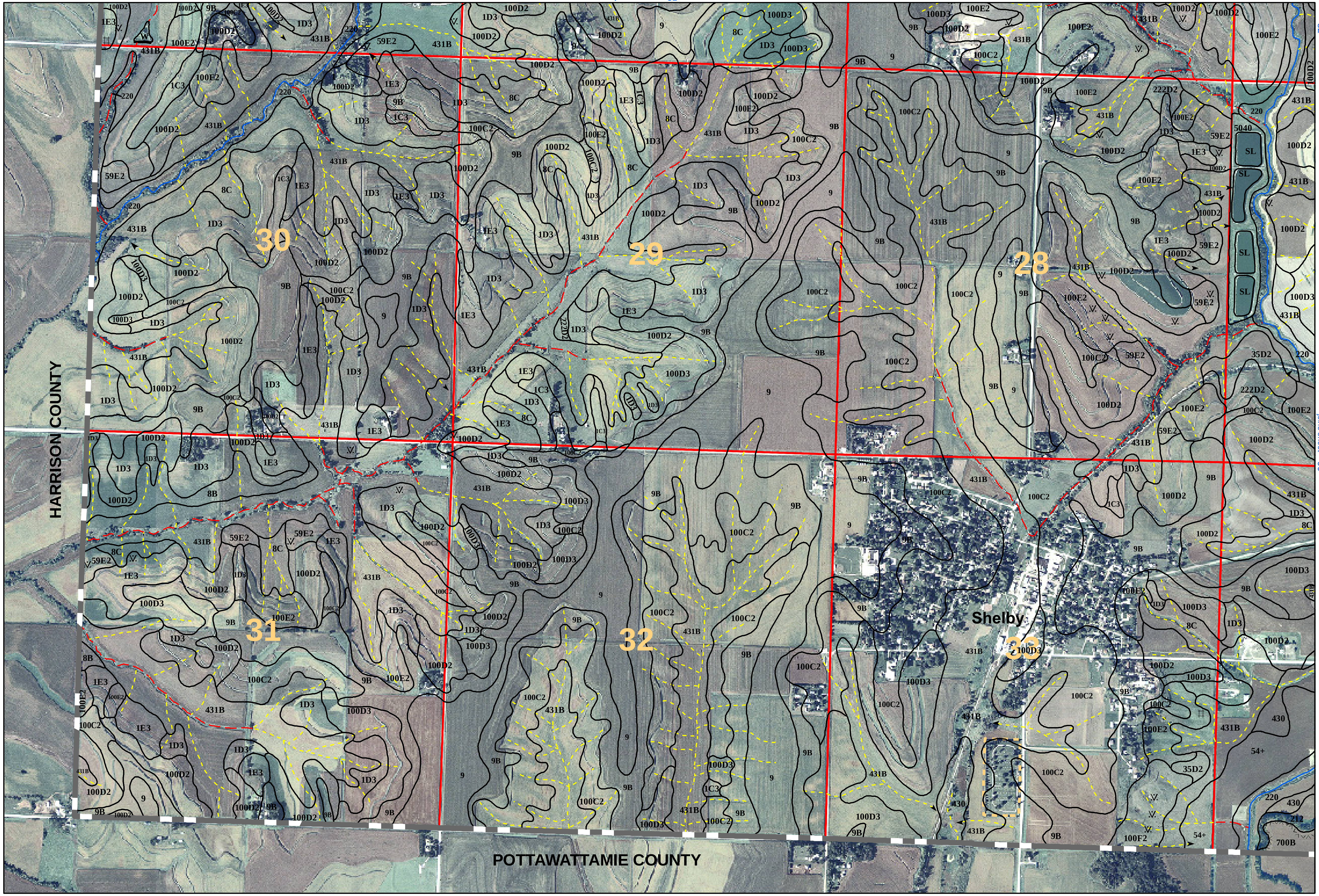
# Township 78N Range 40W

89

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0 1/4 1/2 3/4 1 Miles

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# Township 78N Range 40W

90

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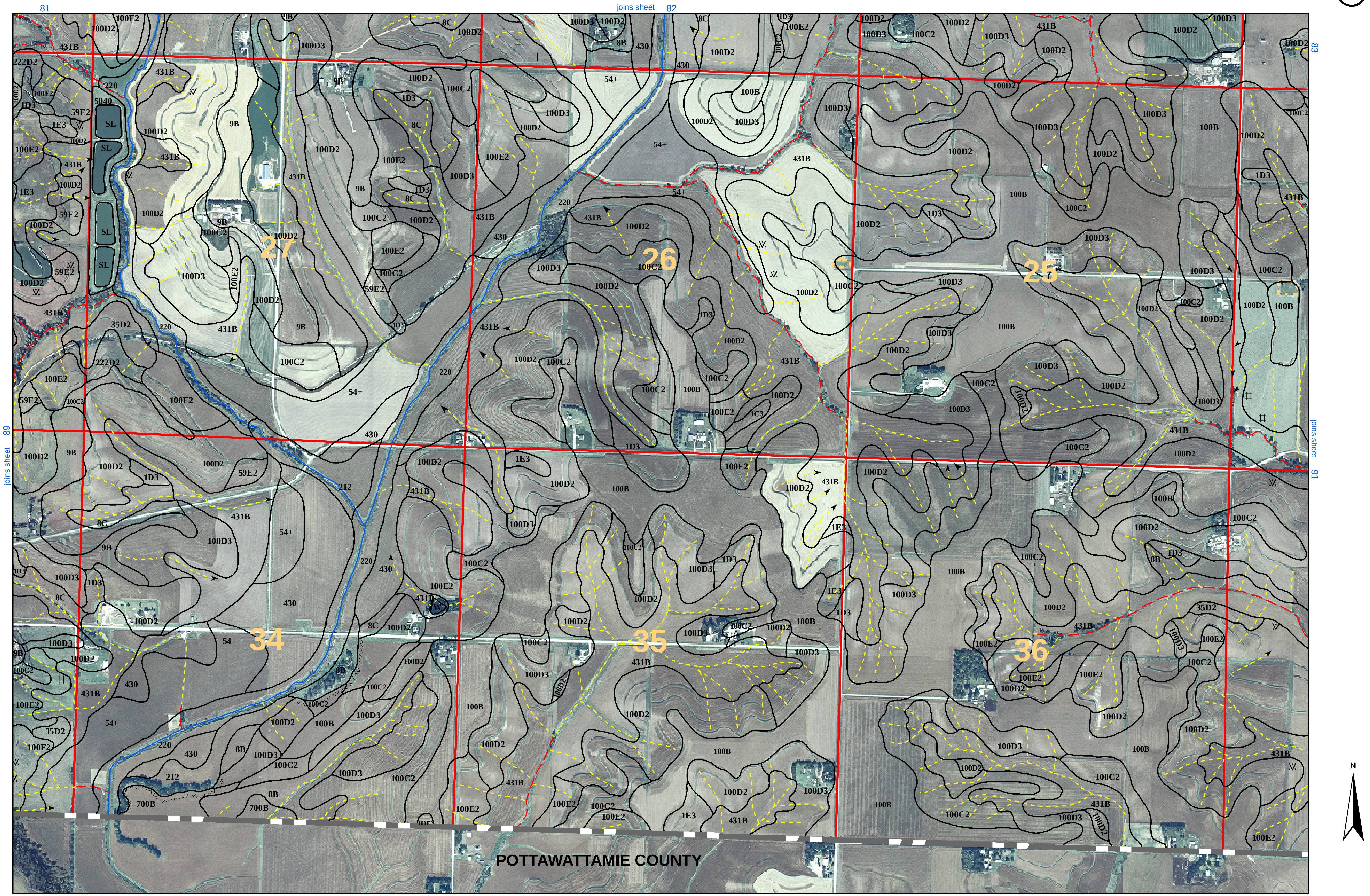


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# Township 78N Range 39W

91

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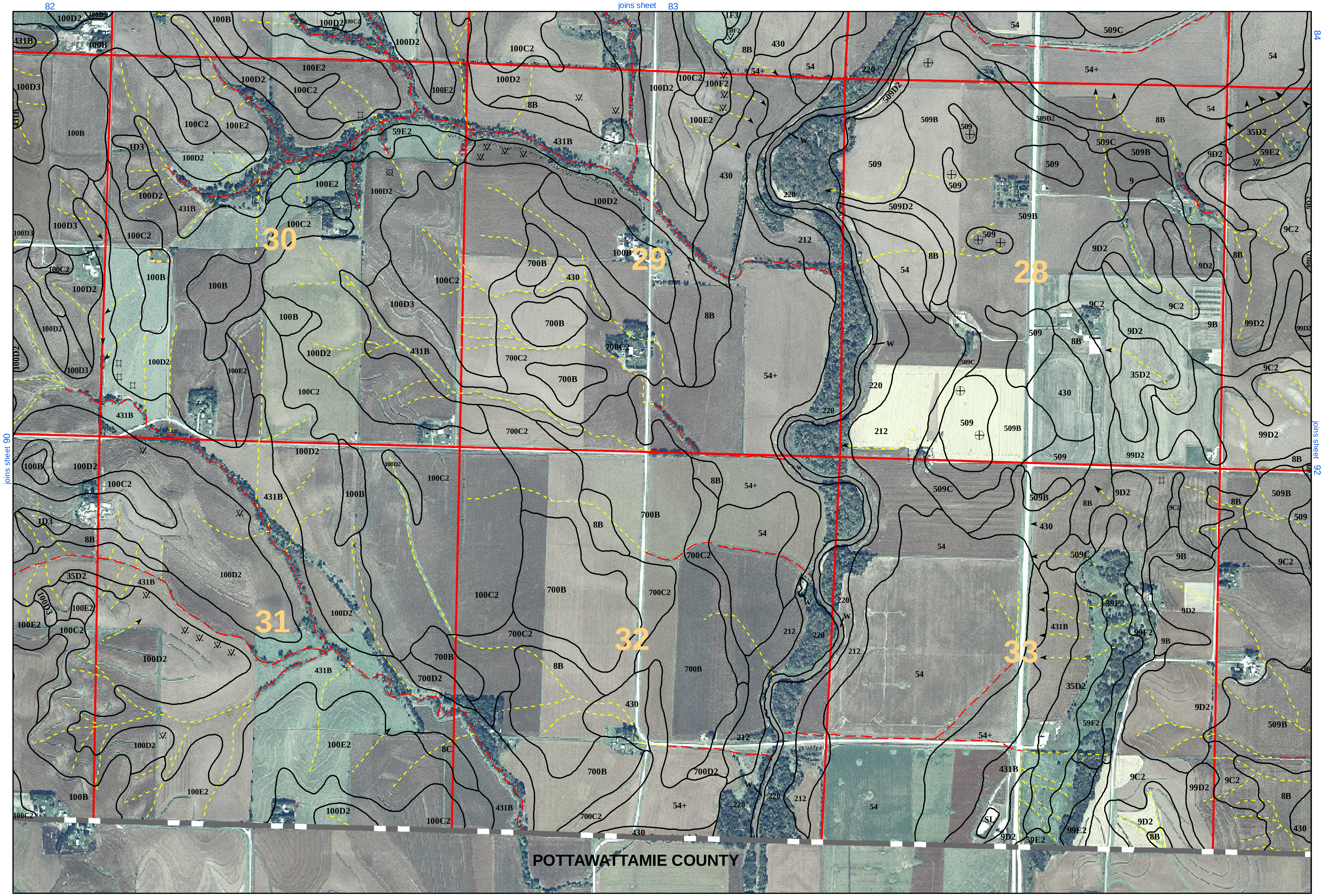


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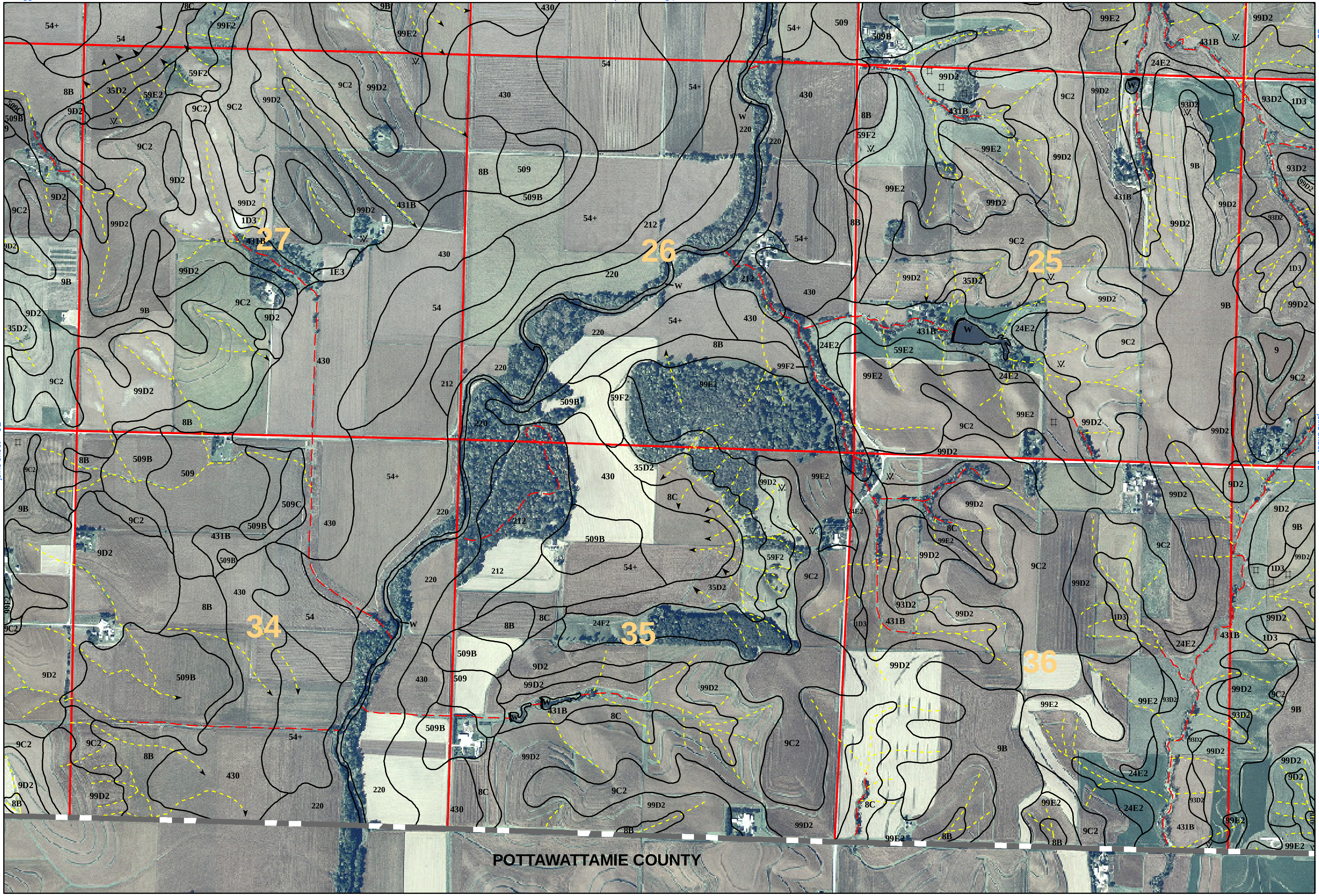
# Township 78N Range 39W



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# Township 78N Range 38W

93

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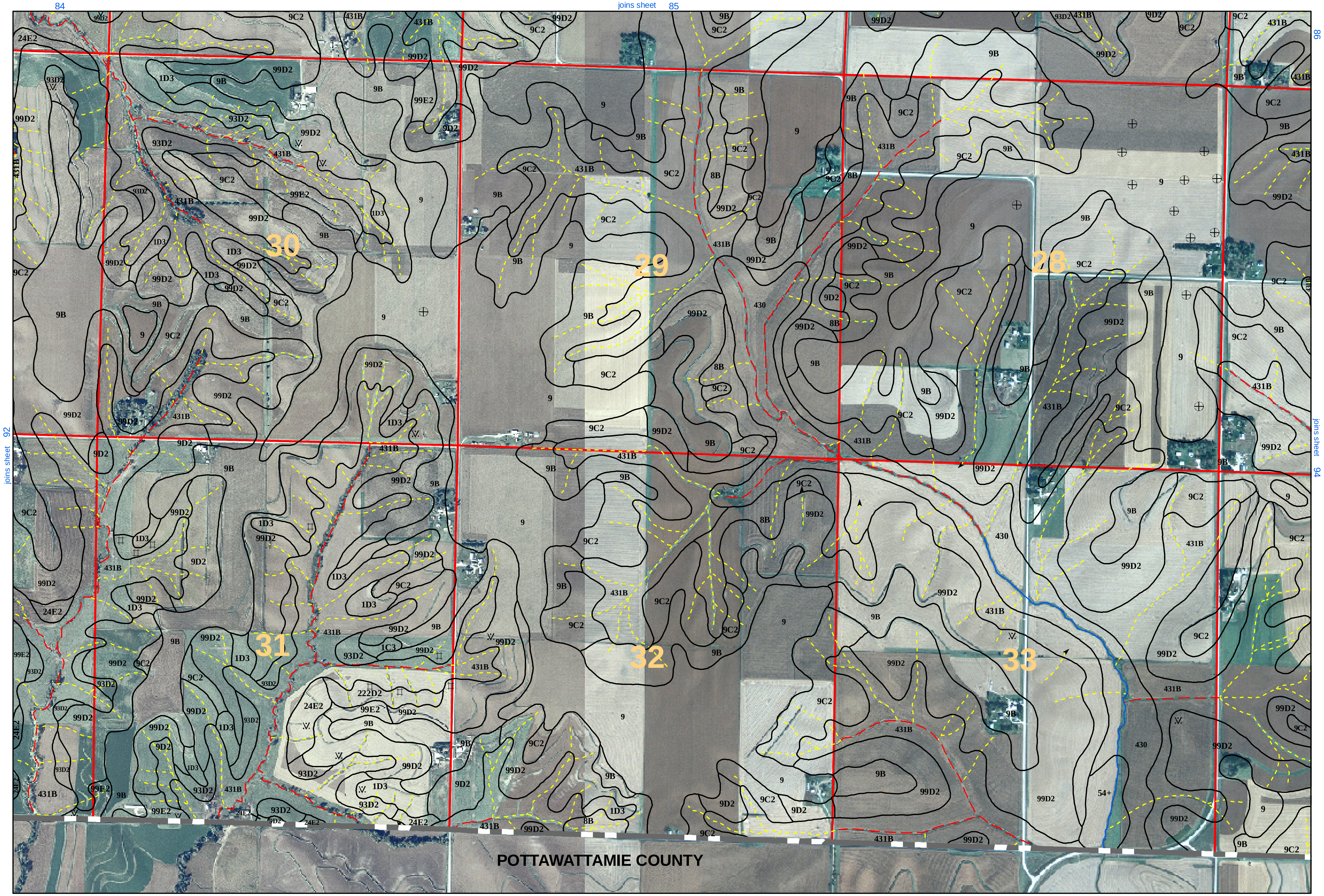


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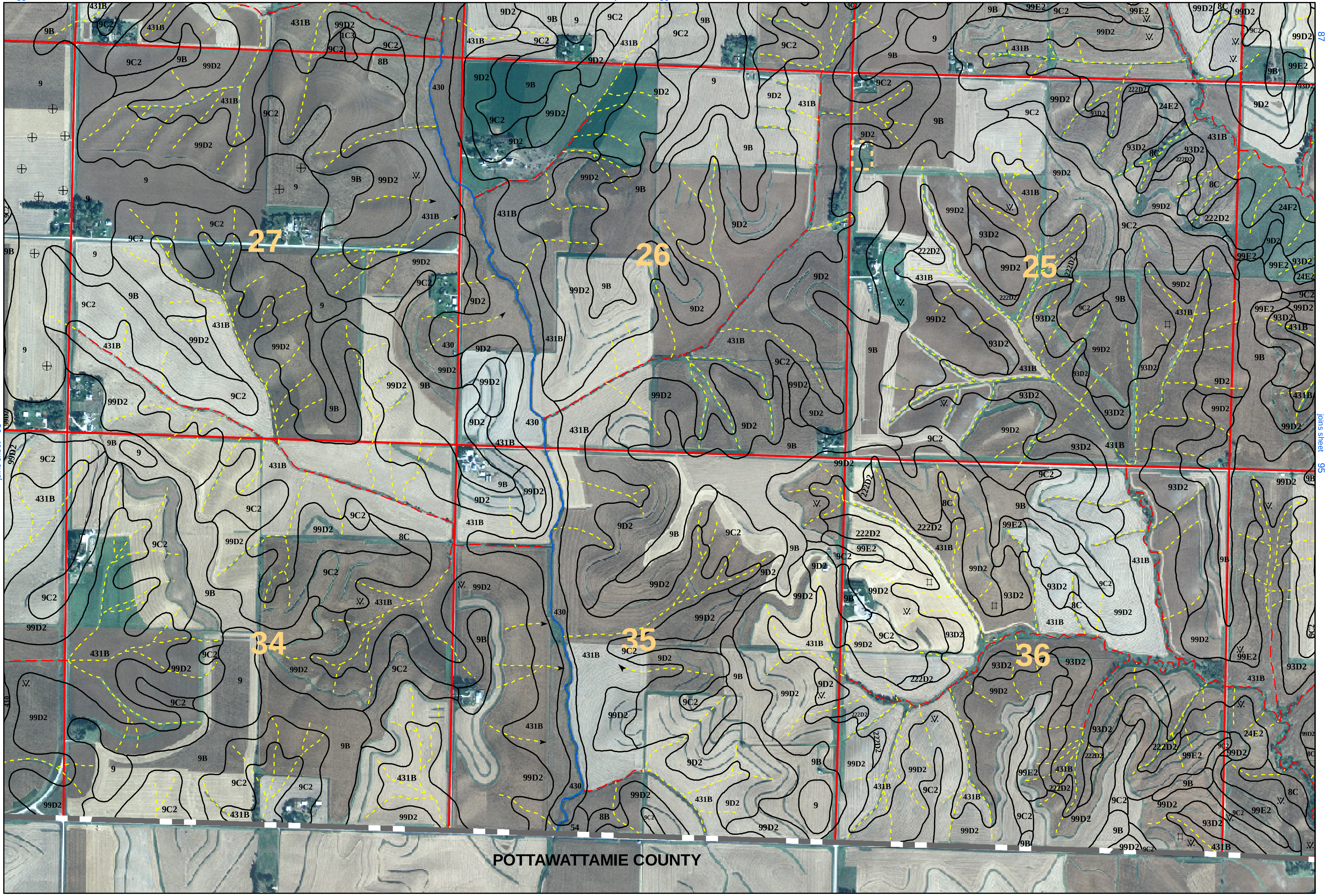


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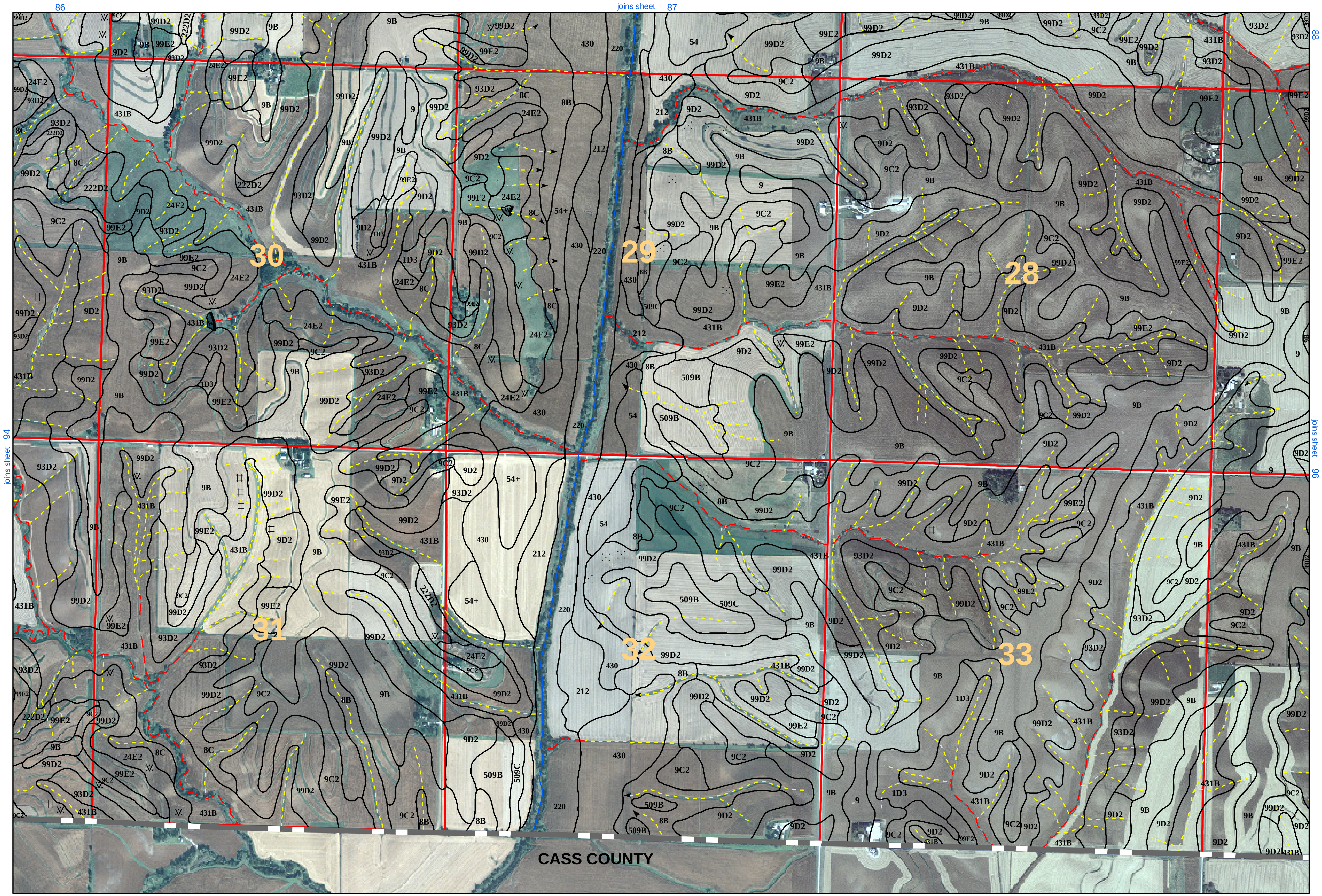


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